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JULY 1990 THE INDEPENDENT GUIDE TO IBM-STANDARD PERSONAL COMPUTING VOLUME 9 NUMBER 13

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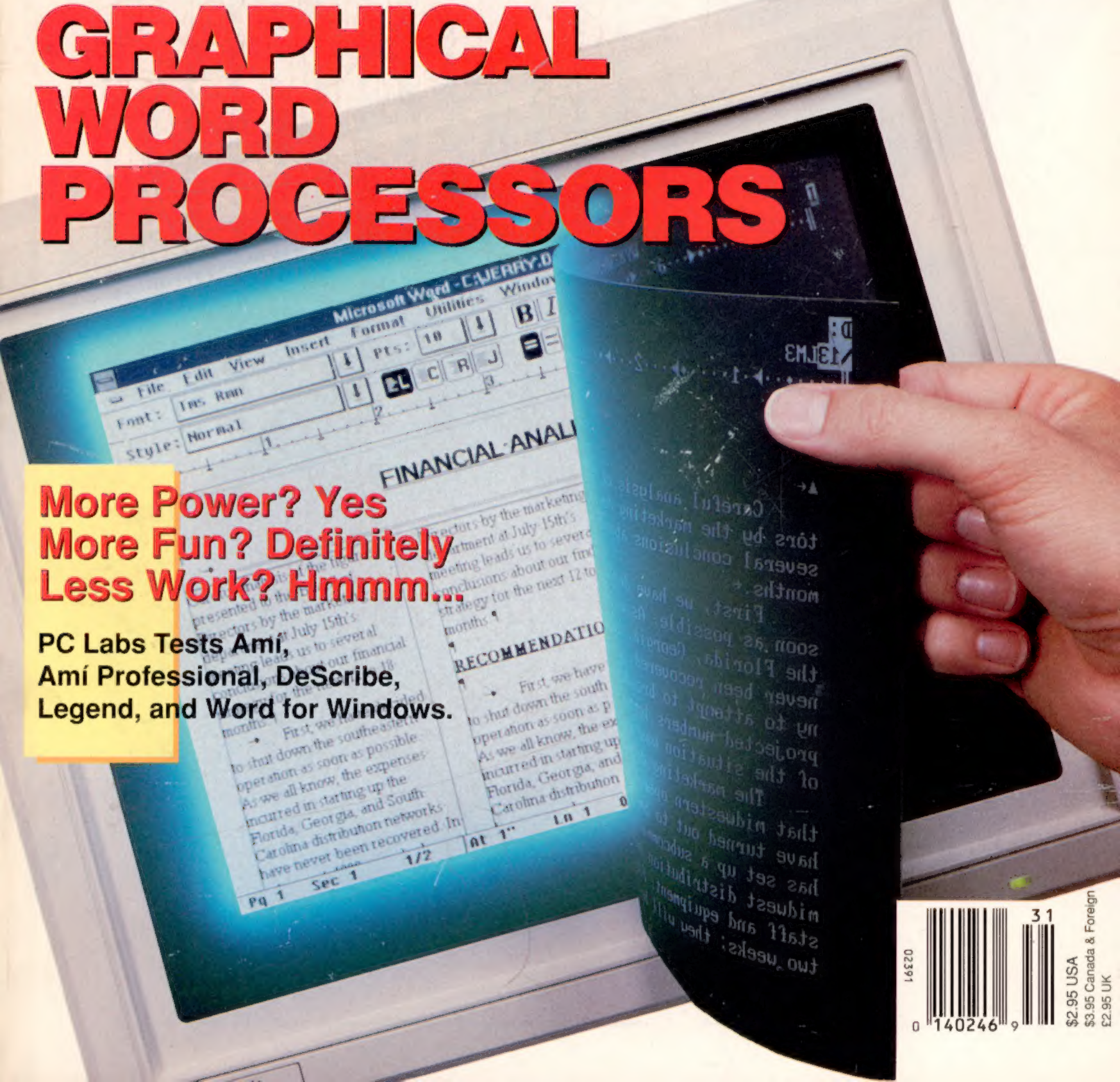

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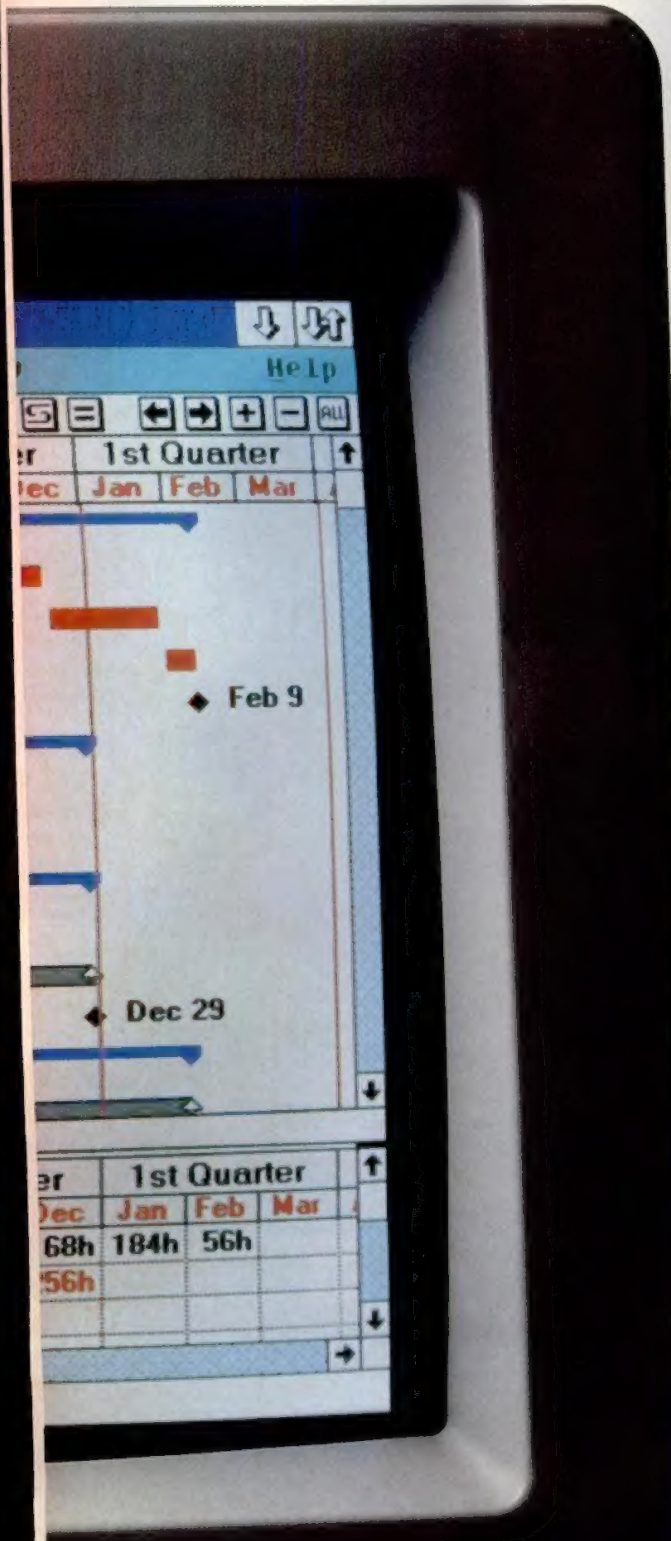

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Inside

When giving advice to PC product developers, *PC Magazine*'s editors are anything but shy. In fact, we have a long history of helping the industry design products you want to buy. John Dickinson, executive editor of *PC Magazine*'s west coast operations since June 1989 and author of this issue's cover story on graphical word processors, has been giving Microsoft advice on *Microsoft Word* ever since the program first appeared seven years ago.

An early proponent of document management—the ability of a word processing program to search for files based on text within them—Dickinson made sure it was added to *Word*. He also made lots of little demands (an automatic save at user-definable intervals is one of his favorites), and he even wrote a few printer drivers.

John Dickinson, *PC Magazine*'s executive editor of west coast operations, has been a frequent visitor at Microsoft for seven years.

Formerly director of PC Labs, Dickinson beta tested both *Microsoft Word for Windows* and Samna's *Ami* and *Ami Professional*. He first looked at *Word for Windows* in 1988, and soon became a frequent visitor at Microsoft, each time toting a list of features that he felt were missing.

Curiosity about the speed of *Word for Windows* provoked Dickinson to run the package under *Windows* 2.11 on an 8-MHz AT-compatible. "Believe it or not, I was satisfied with its performance," he said. Dickinson also ran the program with a beta version of *Windows* 3.0 on a 25-MHz 486 ("It performed beautifully."). He has said, however, that he'd choose *Ami Professional* for use on slower PCs.

Dickinson is moving again. He just accepted the editor's job at *PC/Computing*, *PC Magazine*'s sister publication, in Boston. We wish him well.

PC Magazine recently received Computer Press Awards in four categories from the Computer Press Association. John C. Dvorak won Best Computer Columnist for Inside Track; editor-in-chief and publishing director Bill Machrone was runner-up. Executive editor Bill Howard and contributing editor Bruce Brown won Best Hardware Review for "286 Laptops Compute En Route" (*PC Magazine*, July 1989).

For the third straight year, the association honored *PC Magazine* in the Best Computer Magazine category. And, *PC Magazine* was named runner-up for Best Software Product Review, "Integrated Software Gets It Together" (*PC Magazine*, December 26, 1989).—**Donald P. Willmott** ■

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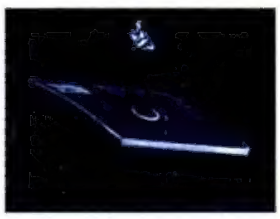

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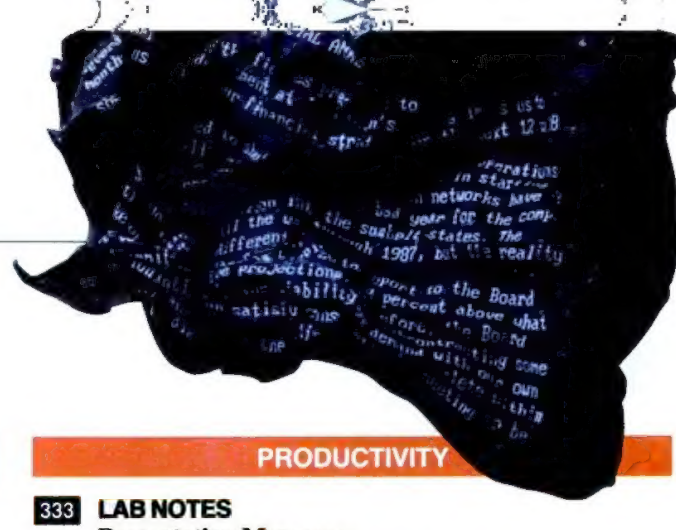

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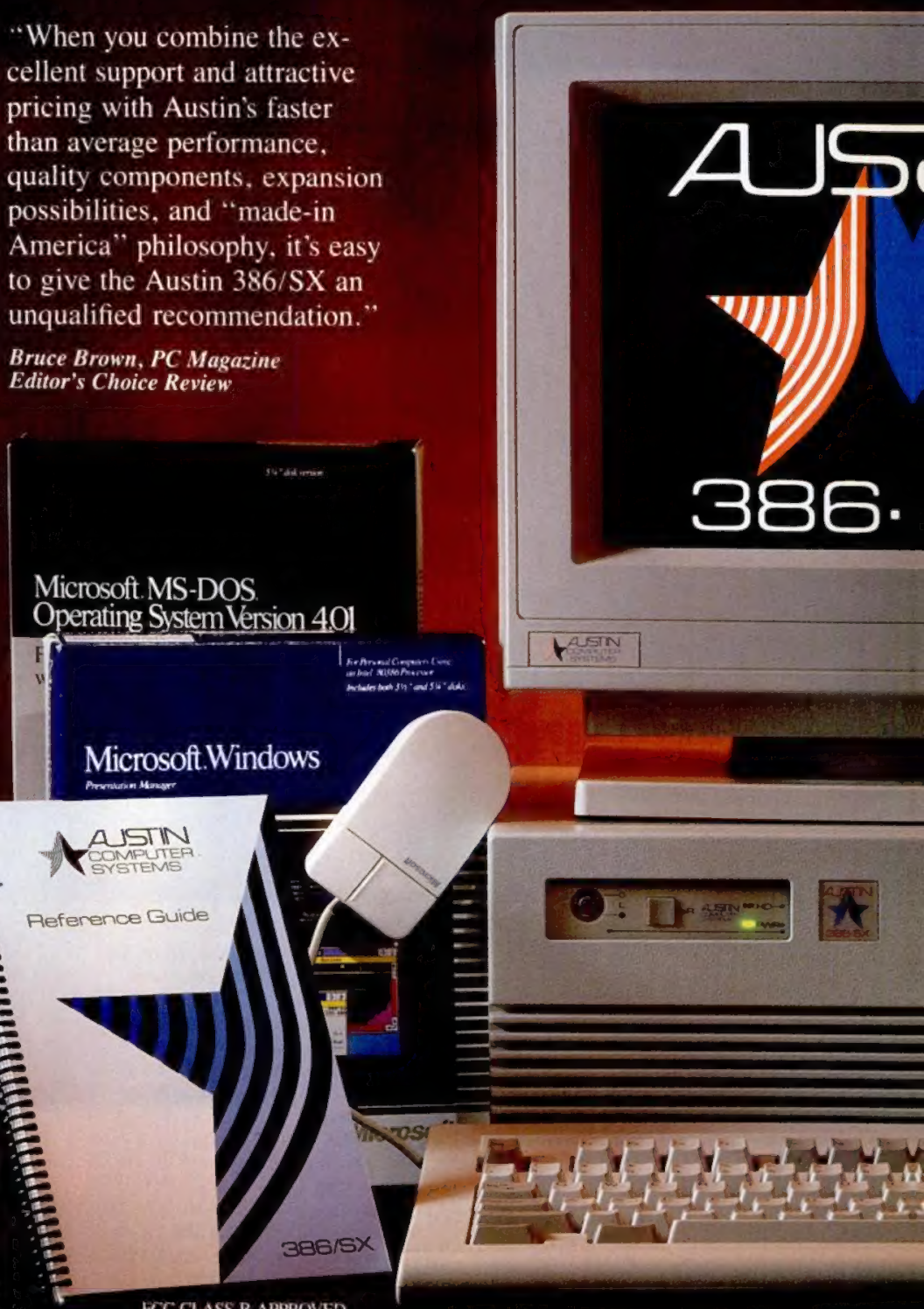

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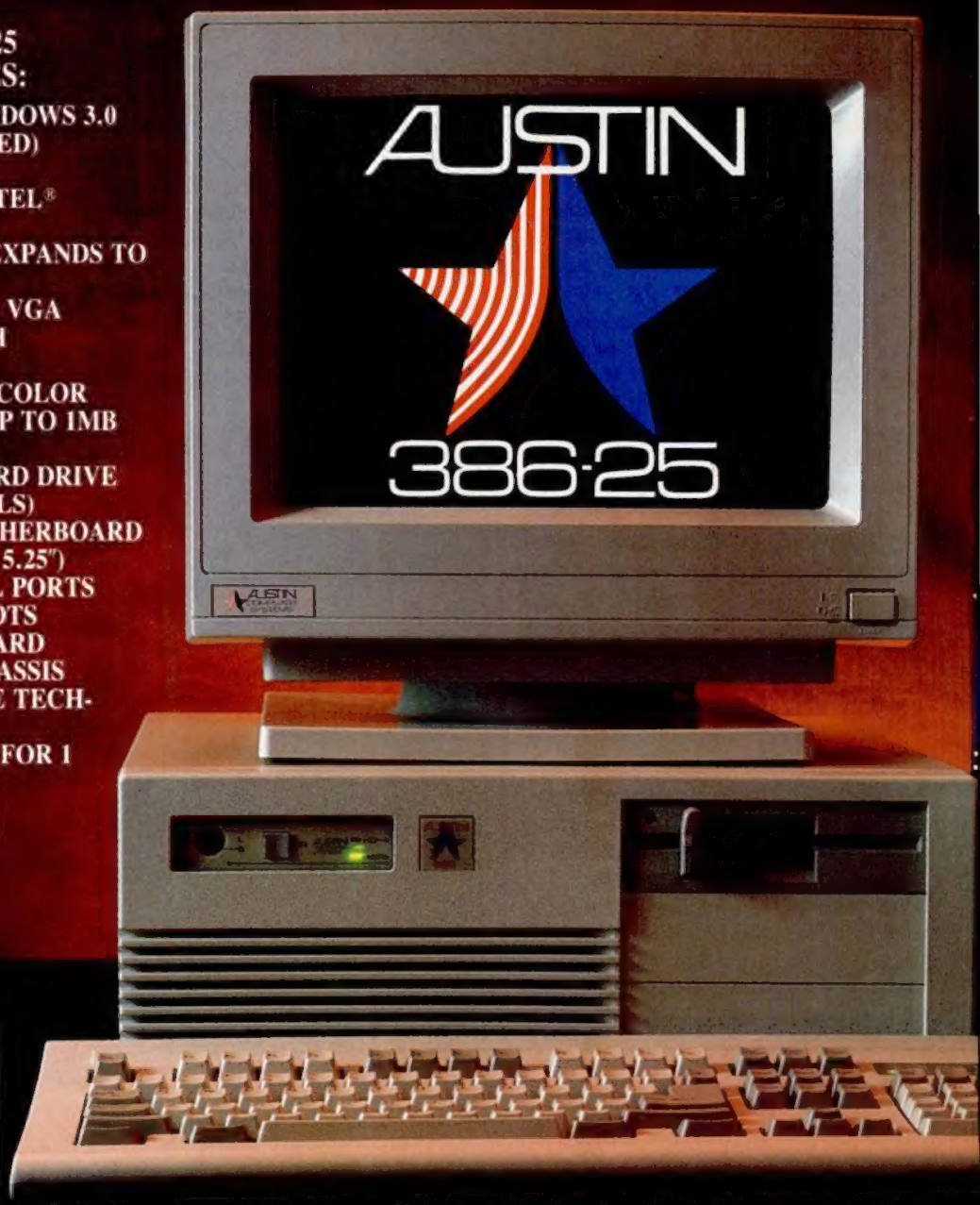

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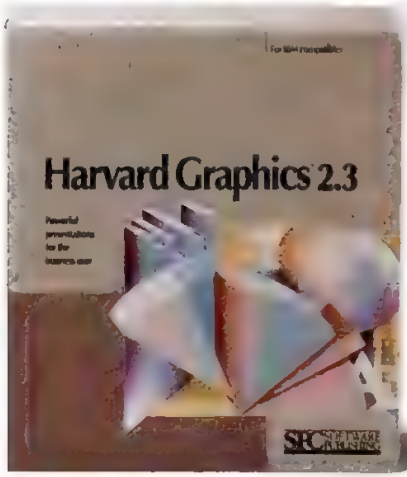

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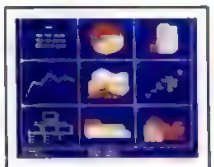

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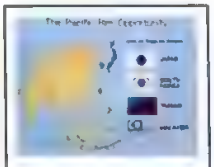

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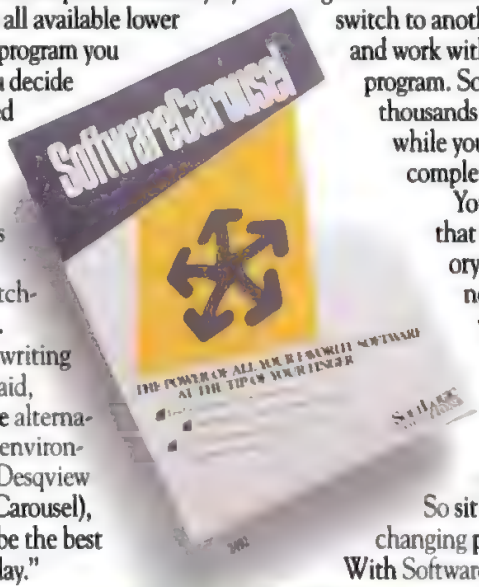

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#6

Letters

GRAPHING SPREADSHEETS

I just finished perusing your review of spreadsheets ("Spreadsheet Heavyweights Take on 1-2-3," *PC Magazine*, April 24, 1990). As a user of both *Quattro Pro* and *SmartWare II*, I have to agree that *Quattro Pro* is probably the best overall choice, at least for those that don't have 286 or 386 machines.

I was a little perplexed, however, at your scoring of *SmartWare*. In the text, you comment that "only seven graph types are available" and in the scoring, you give *SmartWare* a very low grade for analytic graphics. Yet your features table shows that *SmartWare* offers more graph types than any other spreadsheet.

One thing you didn't cover in your review was compatibility of graphics with other packages. I have had outstanding success importing *SmartWare*'s graphs into *WordPerfect* 5.1 documents.

Let me add one more comment—you did an excellent job on the review.

John A. Carter
Seabrook, Maryland

PC MAGAZINE With the exception of *SmartWare II*, all the other spreadsheets we reviewed support more graph types than those listed in our features table. But, in determining the products' suitability to task scores, we considered other factors, including output quality, fonts, and the ability to mix graphics and text.

The features table also provided a list of formats supported by the spreadsheets under the heading Import/Export.—*Ed.*

FINANCIAL USERS OF QUATTRO BEWARE!

As a tool for presentation of financial information, *Quattro Pro* contains a fatal flaw. When using currency or comma formats, both of which are common for financial information, *Quattro Pro* can only produce aligned columns of numbers containing positive and negative values using a simple monospaced font. For all practical purposes, that eliminates your option to use the much richer and more-professional-looking Bitstream and Hershey fonts.

Readers found our spreadsheet roundup to be a hot ticket.

Having used both *Lotus 1-2-3* with *Allways* and *Microsoft Excel* without any problems presenting well-aligned numbers, I was surprised and disappointed when my copy of *Quattro Pro* produced poor-looking output. I hope Borland responds rapidly with a fix for this flaw in an otherwise very impressive product.

Dick Speer
Hudson, New Hampshire

PC MAGAZINE You're right. *Quattro Pro* misaligns negative numbers enclosed in parentheses when a worksheet is sent to the graphics printer. In a product whose strongest suit is presentation, it's a disastrous, intolerable bug. When we contacted Borland, a spokesman said that an upgrade to correct this problem is under development.—*Craig Stinson*

THE WORD ON MACROS

Your Lab Notes column on *Microsoft Word* in the March 27, 1990, issue was excellent, except for one point. I was amazed that M. David Stone did not mention the superb *Microsoft Word Companion Disk* from Peter Rinearson. It contains hundreds of macros and several style sheets. You can use them as supplied or customize them, or you can copy selected items into your own glossaries and style sheets. The disk is worth the price, because even if you don't use the macros, it always helps a macro programmer to see examples of well-structured, working macros.

You also get a vastly superior file of help screens—about twice the size of Microsoft's own help file. Please let *Word* users know that they should dig out their coupon for this item and send it in. It is definitely worth it.

Brian Peck
Milwaukee, Wisconsin

A VIEWPOINT WITH TUNNEL VISION

Jim Seymour makes some valid points about the U.S. personal computer market in his March 27, 1990 column, but cheerleading for U.S. manufacturers is no excuse for racist polemic.

Seymour seems to be infected with the tiresome American habit of putting the U.S. at the center of the universe. He concedes the laptop field to Japanese companies, but whines that they could not have done it without an American oversight: "We left an opening, and the Japanese technology companies grabbed it." And by concentrating on the Japanese, he further dilutes his point by ignoring what's going on in the labs in Taiwan. That's what American manufacturers have reason to worry about.

Outside the U.S., we get used to this tunnel vision in the American media, and can dismiss it with a roll of the eyes. But to rail that "The Japanese believe they're the world's superior race" is far more serious. Assuredly, Japan has its share of extremists, and not a few are in positions of power, but no sensible person would tar all Americans with the brush of Jesse Helms. This shocking ignorance about other cultures, in my opinion, is much more at the

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Letters

root of U.S. trade problems than any country's protectionist policies.

Steven M. Ayres
Kokubunji, Tokyo

A QUESTION OF ACCOUNTABILITY

As a user of TLB's Solomon line of accounting software, I was dismayed by the inaccuracies in your review of *ProfitWISE* ("Price Waterhouse Report: Economy Class Accounting," April 10, 1990).

(1) The limit on database size in Version 1.1 is 10 megabytes, not 5MB.

(2) Version 1.1 allows up to 12 General Ledger report definitions, not 10. It includes among its 10 standard (but user-modifiable) reports a Statement of Cash Flows Worksheet, in accordance with FASB 95 guidelines, a feature not found in most entry-level systems.

(3) Contrary to the claims of the reviewers, *ProfitWISE* does indeed have a way of printing the 1099 information it captures, through the use of the Report & Graphics Designer module.

Obviously, the reviewers did not check out their facts closely enough! I've been a reader of *PC Magazine* since Volume 1 Number 1, and I've come to expect better and more accurate reporting than this article represents.

Bill McHugh
Covington, Louisiana

PC MAGAZINE The *ProfitWISE* database size was accurately stated in the article as 5MB.

ProfitWISE 1.1 does allow up to 12 custom reports. However, it should be noted that the review had already been written when Version 1.1 was released. To ensure that all version differences were reflected in the article, the quantitative aspects of the article were reviewed by TLB Inc., the manufacturers of *ProfitWISE*. TLB did not identify this discrepancy.

While we are aware that the report writing module can be used as described, we do not believe it is relevant to compare a module that increases user complexity and must be purchased at additional cost to what 80 percent of the systems reviewed include as a standard, predefined feature. Also, the use of a report writer to perform a standard function introduces other potential problems, including form alignment issues involved in the printing of 1099s.—*Raymond August*

SETTING THE RECORD STRAIGHT

I must disagree with Mark Robinowitz's claim (Letters, *PC Magazine*, April 10, 1990) that the 688-class attack submarine is a first strike nuclear weapon and therefore Electronic Arts' *688 Attack Sub* game is morally objectionable.

In my 22 years on the Congressional staff as a national security specialist, I have dedicated my life to opposing first strike nuclear weapons. But my work is sometimes made more difficult by well-meaning peace advocates who compromise the credibility of the peace movement by claiming that any American device capable of launching a nuclear weapon is intended for first strike.

The 688-class submarine exists to sink ships. While it has a secondary capability to launch nuclear Tomahawk cruise missiles against land targets, these missiles are too slow for the surprise required for a first strike.

In any case, I understand *688 Attack Sub* deals only with classical nonnuclear naval combat. On that basis, as a flaming liberal dove I would feel no hesitation about buying and playing it.

Robert Sherman
Bethesda, Maryland

Mr. Robinowitz shows laudable but uninformed intentions.

The 688 Los Angeles submarine class is a fast attack submarine, not a fleet ballistic missile (FBM, or "boomer") submarine carrying strategic nuclear missiles. Its main mission is antisubmarine warfare. The obvious conclusion should be that the 688 class of submarine is the best defense against an aggressor's boomers.

Last, as *PC Magazine* responded, most of your readers can distinguish between a game and reality. With the collapse of militant communism, there is better reason than ever to hope that such war games will never become reality.

Philip D. Boettge
LTJG USN (RET)
Medford Lakes, New Jersey

dBASE IN THE PIPELINE

Please allow me to correct a piece of misinformation published in your Pipeline column in the March 27, 1990, issue. In that column, you use SBT as an example of the fact that commercial developers are abandoning Ashton-Tate's *dBASE IV*, and

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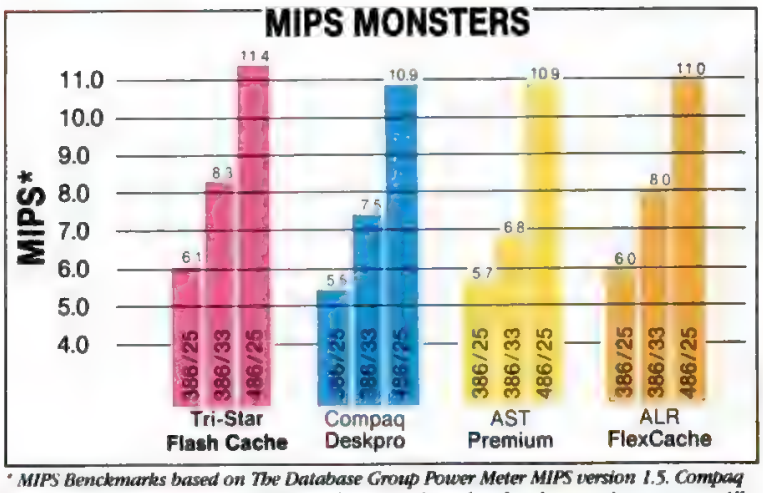

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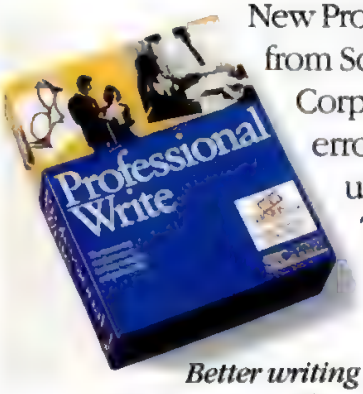

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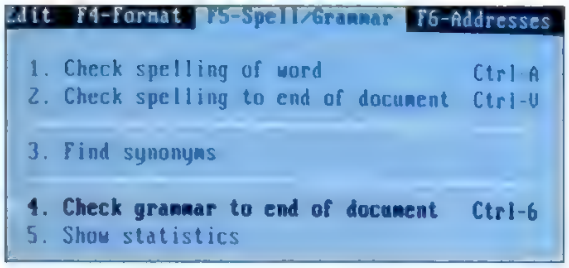

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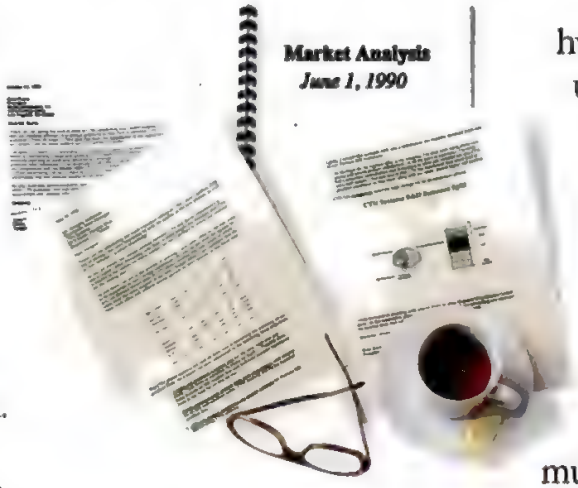

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Letters

state that "SBT now plans to switch to *FoxBASE Plus* for future releases." The statement is untrue, and I regret if we left you with that impression during any of our recent conversations.

SBT's development group is continuing to use *dBASE IV* as a development environment and we intend to support *dBASE IV* in all of our upcoming product releases.

Thomas K. Spitzer
Vice President, Engineering
SBT Corp.
Sausalito, California

PC MAGAZINE SBT Corp. is currently developing source code for both Ashton-Tate's *dBASE IV* and Fox Software's *FoxBASE Plus.—Ed.*

PORTABLES

Much has been written about the new laptops and the promise they hold for greater portability. Everything I've read, including your blockbuster portables issue (*PC Magazine*, March 13, 1990) ignores the fact that none of these machines—not even the Compaq LTE, for instance—features an EGA-capable screen.

At a time when everyone is touting graphical interfaces like *Microsoft Windows* and OS/2, this seems dumb! Has anyone ever asked Compaq about the idea of EGA or VGA in the LTE? Now that would comprise a true and fully functional laptop!

E. J. Hamil
Greer, South Carolina

KEEPING ON SCHEDULE

The best computer utility in the whole world is the one that you were not smart enough to write yourself. I am talking about Michael J. Mefford's SCHEDULE.COM (Utilities, March 27, 1990).

I needed two copies of SCHEDULE.COM on the same computer with separate hotkeys. I decided what the heck, they said I could, so I looked up Mr. Mefford's CompuServe ID number and sent a request for the needed information. He picked up my message and uploaded my answer 2 hours and 17 minutes later that evening. His instructions were so embarrassingly simple that I had two versions coexisting in 15 minutes.

This absolutely blows my image of the big-time magazine writer spending a couple of hours a month writing a column and the rest of the time living it up on high-dollar scotch in strip bars. I thank you, Mr. Mefford.

Jim Moser
Edmond, Oklahoma

CORRECTIONS & AMPLIFICATIONS

The correct phone number for California Freeware (Inside Track, *PC Magazine*, April 24, 1990) is (805) 273-0300.

Because of a printing error, the screen captures from Xerox Imaging Systems' Gray F/X monochrome gray-scale image editor were incorrectly printed in color (First Looks, *PC Magazine*, April 24, 1990). The correct monochrome image of the software appears above.

In the sidebar "The Littlest LCD Panel," the price of the Casio FX-7000G/OHP was incorrect ("LCD Panels: 12 For the Road," *PC Magazine*, February 27, 1990). The correct price is $295.95.

HOW TO WRITE TO PC MAGAZINE

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"33MHz Swan 386 Produces Quickest Hard Drive Times" InfoWorld, February 26, 1990

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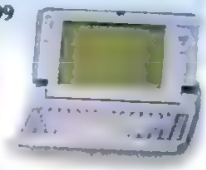

Panasonic's new laptop comes with 640K, 720K floppy drive, serial and parallel port, reflective 640 x 200 full-sized display, & weighs 6.4 lbs. Operates at 8MHz. Carrying case included.

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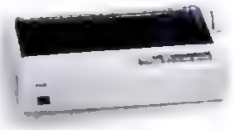

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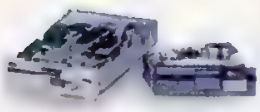

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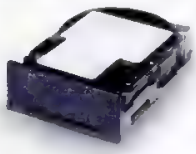

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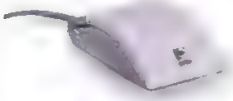
Corel Draw *from Samna* $319
dBase III+/dBase IV ..... $Call/$459
Deluxe Option Board $109
DESQView 2.26/386 ..... $79/$129
Easy Accounting 4.1 *from Dac* ... $85
Excel *from Microsoft* ..... $Call
Fastback Plus $104
Harvard Graphics $309
Lotus 1-2-3 ..... $Call
Norton Advanced Utilities $99
Pagemaker *from Aldus* $519
Paradox 3.0 *from Borland* $449
PFS First Choice 3.0 ..... $89
PC Tools Deluxe 6.0 ..... $89
Quattro Professional $329
QEMM *from Quarterdeck* $39
Quick BASIC *from Microsoft* $67
Quick C *from Microsoft* $67
Quicken *from Intuit* $37
Turbo C 2.0/Prof ..... $107/$159
Turbo Pascal 5.5/Prof ..... $99/$169
Ventura Publisher 2.0 ..... $Call
Windows 3.0 ..... $99
Word/for Windows ..... $219/$329
Word Perfect 5.1 ..... $255
Works *from Microsoft* $99



MICE & MISC.

Logitech
Bus Mouse/with Paint ..... $84/$99
Serial Mouse/with Paint .... $69/$89
TrackMan $89

Microsoft
Mouse/with Windows ... $109/$139

Microspeed
Trackball Bus/Serial ..... $89/$89

Mouse Systems
White Mouse/OmniMouse .. $59/46
Trackball $69

Calcomp
Wiz Digitizing Tablet $149

CH Products — Joysticks
Mach II/Mach III ..... $26/$32
Flight Stick $49

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Enjoy Super VGA display with the assurance that you have guaranteed compatibility with other video modes. This professional multiscanning monitor provides a high resolution of up to 800 x 600. The 14" anti-glare screen, .31 dot pitch, auto screen sizing and centering, and tilt/swivel base combine to reduce eye strain. Accepts both analog and digital input.

***Also available...*Swan TTL Monochrome Monitor**

This inexpensive high-quality amber monitor offers a resolution of 720 x 360 for sharp text and Hercules compatibility on a 12" etched anti-glare screen. Tilt/swivel base included. **$89**

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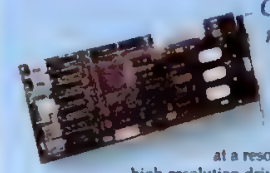
Obtain incredible graphics and speed with Swan's new Super VGA card.



Swan Super VGA Card (512K) $199

Treat your eye to superior clarity and the fantastic colors of Super VGA. The true professional will appreciate the 1024 x 768 resolution of this 16-bit card. With 1MB RAM, you can display up to 256 colors at a resolution of 800 x 600 on a multiscanning monitor. This card includes high-resolution drivers for many popular applications. Supports all VGA modes.

Super VGA (256K) ..... $149 Super VGA (1MB) $229

***Also available...*Swan 8-bit VGA Card**

The affordable VGA solution, this 8-bit card will achieve a resolution of 800 x 600 in 16 colors, or 320 x 200 in 256 colors on a multiscanning monitor. Automatically senses the correct video mode. **$119**

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Swan's new 2400 baud modem allows you to increase the speed of transfer up to 100%.

Swan 2400 baud MNP Modem

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2400 bd MNP Internal ..... $149 2400 bd MNP External $179

***Also available...*Swan 2400 baud Modem**

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External 3.5" 720K ..... $119 External 3.5" 1.44MB $149

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Economical Swan tape backups will store up to 120MB on a single tape cartridge.

Swan Tape Backups CIRCLE 268 ON READER SERVICE CARD

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40MB Internal ..... $269 40MB External $399

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An ant carrying seventeen times its own weight at 60MPH is almost as impressive as our new FileSafe® 8000*Plus* tape backup system. Because the 8000*Plus* packs a giant 152 megabytes into a tiny 3½" size. At an incredible six megabytes per minute.

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CIRCLE 240 ON READER SERVICE CARD

12/26/89
FileSafe 8000Plus

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by Lori Grunin

Advisor

- BIGGER IS BETTER: Utilities that magnify on-screen text.
- COPY INFRINGEMENT QUANDARY: How to deal with a hard disk full of "free" software.
- MORE QUICKEN CHECKS: Yet another low-cost source of *Quicken*-compatible checks.

BIGGER IS BETTER

I have a progressive retina disease called macula degeneration. If my right eye drops to the low vision of my left eye, I will need the characters on my monitor to be at least two inches high to continue enjoying this fascinating computer. Are there any programs that I can use to magnify the screen six to ten times and then scroll it for viewing?

Eugene Lica
Tarzana, California

A reader from Ohio, David Daye, foreseeing a letter such as yours, alerted me to some free publications offered by IBM's National Support Center for Persons with Disabilities (P.O. Box 2150, Atlanta, GA 30055; voice (800) 426-2133, TDD (800) 284-9482), which provide partial guides to computer-based technology available for the physically impaired. These publications include resource guides for people with hearing, speech, learning, mobility, and vision impairments.

While the resource guides offer only lists—not reviews—of the products, they do provide a good starting point for finding any sort of information you might need, as well as lists of user groups and on-line services that may also be of assistance.

From the *Resource Guide for People with Vision Impairments*, as well as from other sources, I have located a few products that can help you out. An all-purpose text-magnification utility, *ZoomText* ($495; AI Squared, 1463 Hearst Dr., Atlanta, GA 30319; (404) 233-7065) seems to address your problem. *ZoomText*, a TSR that works with many applications and with DOS command-line operations, can magnify characters from two (40 characters by 12 lines) to eight (ten characters by three lines) times. You can magnify the entire screen and scroll around, or zoom on only a portion of the screen. The product also allows you to change colors for maximum contrast. An especially nice feature is the smooth font, which lacks the "jaggies" associated with most screen magnifier fonts. The only drawbacks are that it needs an EGA or better display and does not support a mouse. AI Squared will also be coming out with *inFocus* ($149), a similar utility that offers one and a half to two times magnification, and is geared toward reducing eyestrain.

If *ZoomText*'s $495 list price is too steep for your budget, you can also contact Hexagon Products (P.O. Box 1295, Park Ridge, IL 60068; (708) 692-3355), a firm that sells a line of large-font shareware for around $30 each. The products include *B-Pop*, which is quite similar to *ZoomText* but lacks some of the flexibility, and *B-Edit*, a large-type editor that uses *WordStar*-like keystrokes. Hexagon's software is also available in Data Library 4 of the DISABILITIES forum on CompuServe (BROWSE on the filenames BPOP*.* and BEDIT*.*). If you have a Hercules-compatible display, you can try MAGHERC, another shareware pop-up magnifier, which is available in the same location on CompuServe (filename: MAGH10.COM) or from MicroMind ($35; 417 W. 120th St., New York, NY 10027; (212) 222-2849).

COPY INFRINGEMENT QUANDARY

I am facing a dilemma. I was given a used computer as a gift, and the hard drive contains many copyrighted programs. I don't have the original installation disks, the authorization, or any of the other goodies that go to the program purchaser. The drive contains *WordPerfect, Microsoft Word, Lotus 1-2-3, First Publisher, Norton Commander*, and several others.

Am I a lawbreaker, and if I am, how do I go about avoiding severe punishment? I thought of writing to the various companies, but fear I may be set upon by the FBI. The situation also has other drawbacks, such as asking my kids for technical help or posing sly questions around the office.

It would seem to me that as the used-computer market swells, this crime will become more rampant and could overwhelm the legal system. Right now, I'm worried only about my own good name and any advice you can give me on how to clear it would be greatly appreciated.

Name withheld upon request

Rest assured you won't wake up tomorrow morning with the FBI pounding on your front door. Unless, of course, you decide to go into business selling pirated software or start a bulletin board system through which people will pass illegal copies. Most cases of copyright infringement are handled by the Software Publisher's Association (SPA; 1101 Connecticut Ave. NW, Washington, DC 20036; (202) 452-1600) or the individual companies themselves, who file lawsuits in federal courts.

Before filing suit, however, the software company or the SPA will usually send out "cease and desist" letters, warning you of the consequences (a lawsuit). If the piracy problem is rife through a corporation, the suit filer may request that an internal audit be performed.

I'm assuming that whomever gave you the machine with the software installed on it kept all the "goodies" and is using

the programs on a new system: if, on the other hand, they gave you the software (and didn't keep backups or masters) as part of the "gift," then what you have isn't illegal, merely incomplete.

Frankly, if you are in the position of having to "pose sly questions around the office," then go out and buy the software. The "goodies" you refer to aren't just the disks and documentation—they include the right to inexpensive (or free) updates and technical support. And when you skulk about the office in search of furtive technical support, you run the risk of someone reporting you to the SPA's Piracy Hotline ((800) 388-7478).

The growth of the secondhand computer market probably exacerbates the copyright infringement problem because it's so easy to be a passive user of the copies (you don't have to physically make them yourself), and because there's a plethora of books out there meant to supplement (but many are used to replace) the actual documentation. But if the practice becomes rampant, it probably won't overwhelm the legal system, because companies can simply return to the bad old days of copy protection—and nobody wants that.

> The growth of the secondhand PC market probably exacerbates the copyright infringement problem.

In the end, the only proper way to "clear your name" is to delete all the software that you are not licensed to hold from your disk. What would you do if someone gave you a stolen TV set?

MORE QUICKEN CHECKS

Your advice in the April 10, 1990, issue on sources for compatible checks for *Quicken* check-writing software was incomplete. In addition to the two companies you mentioned, there is also Moore Business Products (701 Woodlands Pkwy., P.O. Box 5000, Vernon Hills, IL 60061; (800) 323-6230). The price for standard one-part checks is as competitive as the other two companies you mentioned, and the checks are available in a variety of color combinations at no extra cost.

Kevin Allen
Product Manager
Moore Business Products

PC MAGAZINE At $56.20 for the checks and $27.30 for the envelopes for a total of $83.50, Moore also slides in below Intuit's $92.90, along with Nebs' $79.90 and Deluxe's $88.65. Thanks for the information.

ASK THE ADVISOR

Send your questions to Advisor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload to PC MagNet (see "By Modem" sidebar in the Utilities column for access information). Please specify your equipment. Unfortunately, personal replies are not possible. ■

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CIRCLE 231 ON READER SERVICE CARD

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"Quicken's reports tell me where my money goes and how much I have. Now I'm in control."

"I was making more money. But I wasn't worrying any less. Until I invested $59.95 in a copy of Quicken. Now I always know exactly where my money went. Exactly how much I have. And exactly what I can afford. I never wake up wondering if a big purchase was a big mistake.

The uncertainty is gone. I've never felt so organized about money.

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Where did my money go? As I pay my bills, Quicken automatically notes each type of expense—utilities, clothing, charity, whatever. Then a simple keystroke gives me a report showing how much I spent in every expense category each month.

How am I doing? Another keystroke shows my budget vs. actual. Credit application? In seconds I've got a financial statement showing income, expenses, and net worth. Tax time? No sweat. Quicken provides one report with all my itemized deductions.

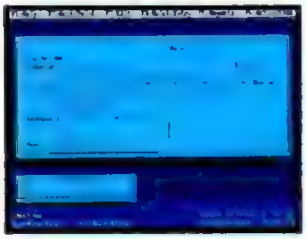
It's fast.

Time to pay bills? Quicken has "memorized" all my regular payments. I just confirm the amounts and Quicken prints checks for me to sign. I still use my regular checkbook when it's more convenient. Or I can pay my bills electronically through the CheckFree payment service.

SPECIFICATIONS
IBM: All IBM PC, XT, AT, PS/2, and compatibles with 320K RAM and DOS 2.0 or higher. **Mac:** All with 512K RAM. Both versions work with all monitors and printers. Feature sets vary. Balance Sheet report not available for Mac. CheckFree not available for Mac, or outside the U.S. Unlimited FREE technical support. Not copy-protected.

It's easy.

I just pulled out the Quick Start Card and typed "install." That simple. I was up and running in 6 minutes. The screen even looks like my checkbook. There is nothing new to learn. No complicated instructions. I just might read the rest of the manual to see what more Quicken can do.



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-PC MAGAZINE

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The new ZEOS 386SX simply runs circles around every other 386SX out there (not to mention all those '286 based machines). As PC Magazine noted, the ZEOS 16MHz 386SX compares "favorably with the 20MHz '286 machines reviewed in 'The 80286: Unsafe at Higher Speeds?'" (PC Magazine, December 27, 1988).

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CIRCLE 145 ON READER SERVICE CARD

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BYTE Magazine January, 1990

$1495...

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There's no better way to describe the award-winning ALR PowerFlex. One look, and you'll know why this is one of the industry's best-selling 286-based personal computers. This innovative system comes standard with a **12.5-MHz 286** processor, **1-MB** of memory, and a **40-MB** hard drive — all for the remarkably low price of **$1495**! And that's just the beginning.

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"ALR has executed a masterstroke that could influence the way all computers are built." *(PC Resource December, 1989)*

With six expansion slots and four drive bays, the small-footprint cabinet of the PowerFlex was also designed for the future. This system has the performance and expandability you need for today's standard office applications — such as spreadsheets, word processing, and even desktop publishing — and the ability to adapt to your future needs as well. For more information about the innovative ALR PowerFlex, please call:

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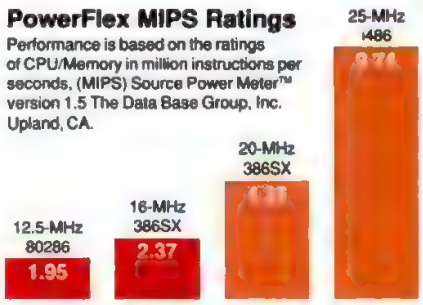
PowerFlex MIPS Ratings

Performance is based on the ratings of CPU/Memory in million instructions per seconds, (MIPS) Source Power Meter™ version 1.5 The Data Base Group, Inc. Upland, CA.



CIRCLE 165 ON READER SERVICE CARD

First Looks

Hands-on Reviews of the Latest Products

Windows 3.0 Brings Icons, Multitasking, and Ends DOS's 640K Program Limit

ToolBook
HyperCard-like tool makes development for *Windows* easy 36

Microsoft Project for Windows
Graphical project management package offers rich set of features..... 38

Query 2.2
SQL-based engine delivers data in graphic form 43

Monotype Typeface Library
Brings classic fonts to PostScript users..... 44

HANDS ON
by Gus Venditto

A funny thing's happening on the road to OS/2. *Microsoft Windows* has turned into the dazzling multitasking operating system that OS/2 is still struggling to become.

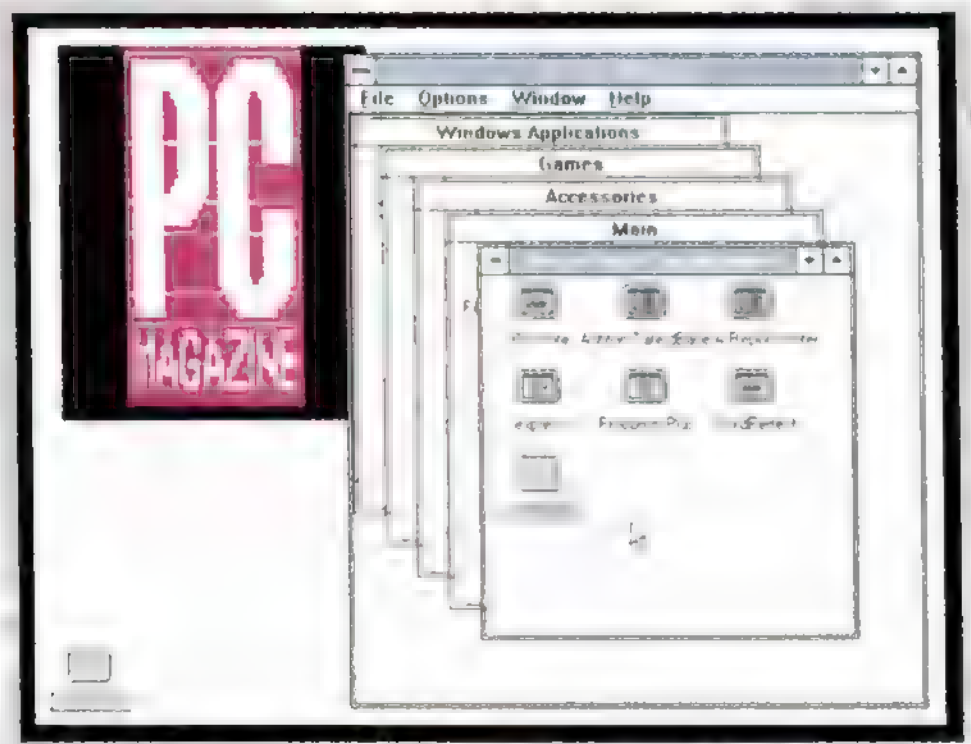
The release of *Microsoft Windows* 3.0 represents the best implementation of a graphical environment for PC users available anywhere.

Win 3 not only lets *Windows* applications use all the memory in the system, but it multitasks so smoothly on a 386 that you can easily use it as a front end for all of your DOS applications.

Windows 3.0 features the same screen design used in OS/2 1.2. But since *Win 3* offers compatibility with current *Windows* programs and a 386 mode that runs multiple DOS sessions, it is an irresistible alternative for power-hungry users aching to break out of DOS's 640K limit.

This upgrade has raised talk of trouble for Apple and NeXT, and it's not hard to see why. The clean design of the icon-based screen, the fast response time, and the ease with which most anyone can get up and running under *Win 3*, puts everything in an entirely different perspective.

Any DOS application can become an icon in a *Windows* folder. Just double-click and run, quit and return to *Windows*. Forget about batch files and paths; you tell *Windows* about the path once, and be done with it.



Virtually every aspect of *Windows* 3.0 can be customized, from the way you organize your applications to the background screen. It took 5 minutes to capture this *PC Magazine* logo from our benchmark program and load it as the wallpaper in a *Windows* opening screen.

With a DOS application running in *Windows* 386 mode, a quick Ctrl-Esc key sequence will switch you back to your *Windows* Program Manager, and off to yet another DOS application. The same kind of program switching is possible on 286 and 8088 PCs, but at a speed that most people won't find tolerable.

There's a lot here for everyone, but it can be totally confusing without a basic understanding of the three distinct operating modes (see sidebar).

Real mode is the ground floor. It's really here for compatibility; it's the only mode that 8086s and 8088s can use, and it's the only mode that will run the *Windows* applications that are currently shipping. It looks better than *Windows* 2.01, since it's icon based and uses shading to accent screen objects. It falls short if you want to go beyond DOS's 640K barrier, though.

Standard mode is for 286s and 386s. New versions of *Windows* applications will let you use all of the available system memory, and that's going to provide a major performance boost to memory-constrained programs like *PageMaker* and *Microsoft Excel*. The *Windows* programs you now own won't run in this mode (unless you recently bought Microsoft's newest version of *Excel* or *Word for Windows*), but software publishers are ready with upgrades for just about every application.

386 Enhanced mode pulls out all the stops. Going even beyond OS/2, it lets you multitask DOS applications.

What can you do in this mode? Start a coffee-break-long number-crunching session, and then switch to another DOS application. Now switch to *Windows*. Start as many separate sessions as you like—the numbers will keep crunching at a respectable rate.

Not even RAM is a limit, since Enhanced mode will page data to disk when it runs out of memory. You won't want to let it run out of RAM, though; your system will snap, crackle, and pop its way through commands so quickly that you'll be heading out to the store for extra RAM chips if it ever starts paging to disk.

This is the level of performance that has gotten develop-

CONTINUES ON PAGE 34

CONTINUED FROM PAGE 33

ers like Lotus and Software Publishing to change their OS/2-based strategy to include *Windows*.

Semi-Intelligent Setups

The Setup program will even do a fairly good job of getting *Windows* ready to run every DOS application it finds on your hard disk. It's not perfect, but it makes a pretty good guess.

For example, it did a perfectly good job of setting up *ProComm Plus*, *XyWrite*, *Lotus 1-2-3*, (Releases 2.01 and 3.0), *Q&A*, and *dBASE IV* on my Compaq Deskpro 386/20. It created a folder that it titled "Non-Windows Applications," and all I had to do to run any of these applications from within *Windows* was to double-click on the folder, and then double-click on one of the labeled icons.

Curiously, it botched the "DOS Prompt" installation; when I double-clicked on DOS Prompt, I got an error box asking me to insert COMMAND .COM in drive A:. (The fix wasn't too difficult: insert "C:\" before the COMMAND .COM listing under the Properties box for the DOS Prompt icon.)

These auto-installations are a big help only if you regard them as a beginning, rather than a completed configuration.

For example, when I chose the *ProComm Plus* icon, it was up and running in a second. It seemed to be running perfectly well, but *Windows* popped up a warning that the program was ill-behaved and I ought to quit it. I did, ran the *Windows* PIF Editor, and tried a simple experiment. I changed the default setting for Video Memory from High Graphics to Text. This time, *ProComm* ran fine and I was able to dial up PC MagNet, start a file download that would take 19 minutes, Ctrl-Esc my way back to *Windows*, and then open another DOS session for some word processing.

About 23 minutes later, the file download was complete, and I was able to switch over and close the on-line session without having to close the word processing document.

MS-DOS Executive Gives Way to File Manager

In changing to an icon-based structure, *Win 3* retires the MS-DOS Executive, replacing it with a Program Manager. The initial *Win 3* screen is a Program Manager screen that holds folders, each of which stores icons for programs. After installation, *Windows* presents you with as many as five folders. They include the main folder, composed of File Manager, Control Panel, Print Manager, Clipboard, DOS Prompt, and the Setup program (useful for changing hardware options); an accessories folder, composed of "applets": PIF Editor, Terminal, Paintbrush, Notepad, Clock, Calendar, Calculator, Write, Calendar and Record (a macro manager); Games, with Reversi and Solitaire (a sensational rendition of the familiar card game); *Windows* applications, filled with all of the *Windows* applications that the Setup program detects on the disk; and non-*Windows* applications, filled with the DOS programs Setup detects. This folder is created only if you select the option that instructs the Setup program to make its best guess at installing these programs.

A Lot to Keep Straight

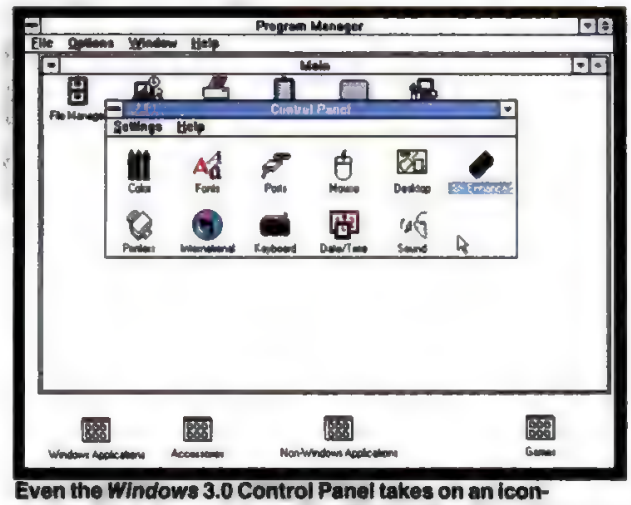
Few of the new accessories will prove powerful enough to become everyday applications, though you may find yourself using them more since they're readily accessible. The folder concept is a good device for keeping programs always within reach, yet neatly arranged.

THE THREE SIDES OF WIN 3

by Gus Venditto

The *Windows* 3.0 Setup program analyzes your configuration and then makes its best guess on which of three operating modes you should use. Then *Windows* 3.0 is ready to run in that mode. But you can still run *Win 3* in one of the other modes by loading it into memory with a command line switch. In fact, you'll have to change the mode if you've got a well-equipped system and want to run current *Windows* applications, since *Microsoft Windows* 3.0 will automatically install itself for a better mode than the one that will run older applications.

What Microsoft Calls It	How You Load It Into Memory and What It Does Once It's Running
Real Mode	WIN /R Runs *Windows* 2.01 applications within 640K RAM and with the new interface. Lets you switch among multiple DOS and *Windows* programs, but the 640K limit makes that impractical.
Standard Mode	WIN /S Runs only *Windows* applications modified for *Win 3*. Lets you use all of the memory in your system to run programs and load data. Good for multitasking *Windows* applications but slow at switching among DOS applications. 386 PCs with less than 2MB RAM will run faster in this mode than in Enhanced.
386 Enhanced	WIN /3 Runs only on 386 and 386SX PCs with more than 1MB and really requires more than 2MB for best performance. Runs only *Windows* applications modified for *Win 3*. Very good at multitasking both *Windows* applications and DOS programs. Lets you use all of the RAM in your system to run programs and load data, and will turn disk space into virtual RAM, if needed. ■



Even the *Windows* 3.0 Control Panel takes on an icon-oriented feel. You can install a new .PCX file as a background graphic by choosing the Desktop options.

CIRCLE 512 ON READER SERVICE CARD

FACT FILE

***Microsoft Windows* 3.0**
Microsoft Corp., One Microsoft Way, Redmond, WA 98052; (206) 882-8080.
List Price: $149; upgrade, $49 plus $5.50 shipping.
Requires: 640K RAM; hard disk; Hercules, CGA, EGA, VGA, or 8514/A graphics adapter (better than EGA recommended); DOS 3.1 or later.
In Short: With this release, *Windows* can be used as a full-time environment that multitasks on 386s. It will run on low-end machines, but a 286 or better—and lots of RAM—is recommended.

CIRCLE 444 ON READER SERVICE CARD

And you probably won't like Microsoft's default arrangement; it's impossible to keep straight whether Clipboard is in the accessory or main folder. You don't need to, though, since you can create new folders and store the programs in any arrangement you like.

Or, you may prefer to run the File Manager as your main screen. You can run an executable file simply by double-clicking on it. If you do, you've got more patience that I have; you'll be inclined to check your wristwatch as File Manager churns its way through every file on the disk.

It's essentially the same File Manager introduced with OS/2 1.1 and offers a Move command, easy Attribute control, and several ways to display a directory structure.

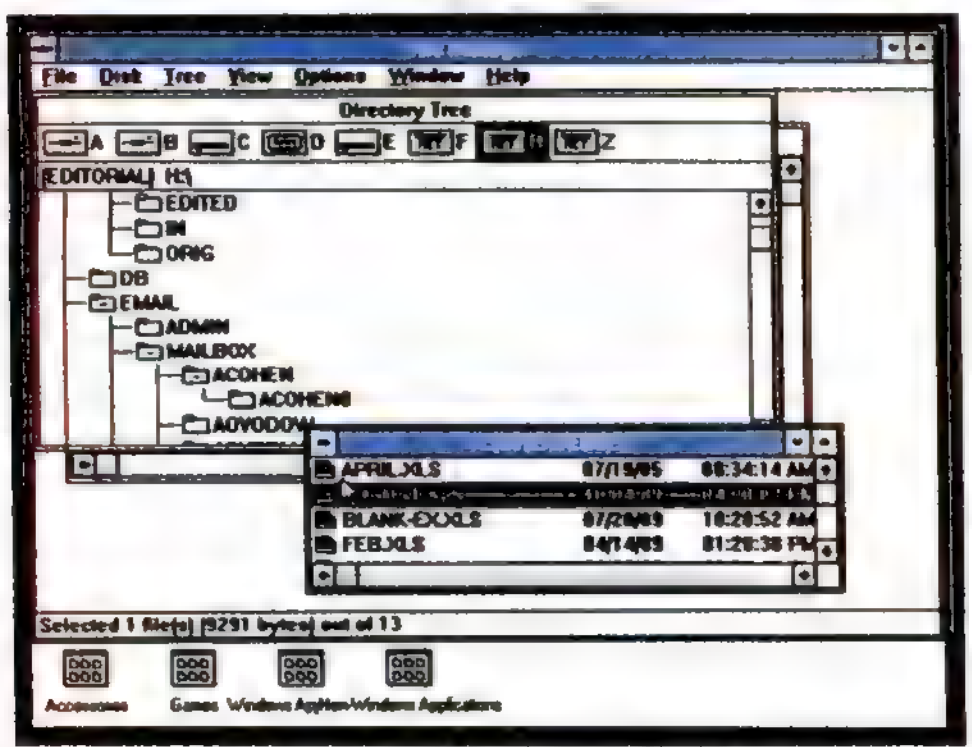
With so much power within such easy reach, it's not difficult to find yourself lost, especially when program icons and folders become obscured by menus. The Program Manager can help you find a lost folder, and the Task Manager can help you switch to an active session, but you won't become proficient without total immersion in this new environment.

And be careful how your screen looks when you quit. The default "End Session" menu setting saves the current arrangement of menus and folders, so you may find that after you've carefully arranged your desktop the way you want it to be when you start work, *Windows* will have saved the end results of an active session.

There are so many customizable options, though, it's hard not to love the program. Even the background screen (which Microsoft calls "wallpaper") can be changed to display a custom design, so you can have your company logo on the opening screen with a .PCX file and a 5-minute change to the default settings.

When you encounter problems, there's usually an easy workaround. Novell users, for instance, need to replace the network shell (NET3.COM or NET4.COM) to run *Windows* in 386 mode; you can drop down to Standard mode in the meantime. (Novell's already published the updates.)

The transition to using *Win 3* at top performance will take time, as you acquire upgrades for standard applications. But with enough memory in a fast system, *Windows* 3.0 breaks through so many barriers that it's easy to feel like you're making a fresh start. ■



The *Windows* 3.0 File Manager provides most DOS functions. After moving the cursor to a filename, you can perform a wide range of file operations, including Move. Note that RAM disks and network drives are labeled.

IT WILL BE HARD TO MISS

This is one product that *won't* catch the PC industry off guard.

Microsoft has actively encouraged software developers to write software for the platform for over a year; about a hundred are ready with upgrades to existing *Windows* applications or new programs that were being held until *Win 3*'s completion.

An example of both approaches is in desktop publishing. Aldus has an upgrade for *PageMaker* that provides a major performance boost, even though it does little more than enable *PageMaker* to run in *Window*'s large memory space. Meanwhile, Xerox will use *Win 3* to finally release the first version of *Ventura Publisher* under *Windows*.

And a lot of PC systems vendors aren't even going to wait for people to ask for *Windows*: Zenith, NCR, Tandy, Gateway, Northgate, Zeos, AST, and more than 20 others will install it on every new 386 machine they sell.

In addition, Microsoft expects to ship more than 400,000 demo disks and plans to hold hands-on demo sessions in dozens of cities over the next six months.

Not surprisingly, Microsoft has two new applications (*Project for Windows* and *PowerPoint*) to round out its family of *Windows* applications.—G.V. ■

MICROSOFT WINDOWS 3.0: Great? Yes! Perfect? Hardly

by Bill Howard

Microsoft products, as a rule, are full of promise, late to market, quirky in their early versions, but then they mature into world-beaters.

Windows 3.0 is great already, but it's not perfect. And despite what you may read in the general press, it's not the equivalent of the Mac. Yet. Think of *Windows* 3.0 and the underlying PC platforms as providing 90 percent of the Mac's ease of use for half the price.

So what's the missing 10 percent? *Windows* doesn't go far enough in providing true ease of use. Here's just one example: The *Windows* File Manager (which is painfully slow, by the way) lets you move a file by dragging its icon from one directory to another, and it warns you if you're about to overwrite another file. But it doesn't tell you which file is newer or bigger, and there's no file-contents browser like Vern Buerg's LIST program or even DOS's TYPE command so you can take a look-see. Instead, you have to expand the File Manager windows (slowly) to see the size and date stamps, or pop back into DOS and compare the two files with a DOS command.

And the whole idea behind *Windows* is supposed to be that of a full-service vacation resort—everything you could possibly want without ever leaving the premises. In its current version, you'll need to take the shuttle bus into town every now and then.

Do I hate *Windows*? Hardly. Like many editors at *PC Magazine*, I've been using, and cursing its multitasking predecessor, *Windows/386*, for two-plus years now. *Windows* 3.0 is a quantum leap forward in ease of use and reliability. And it's axiomatic that you complain most about the shortcomings of the products you use most because they're so important to you and your PC. *Windows* 3.0 is sensational, if slightly incomplete. ■

ToolBook Puts Windows Development in the Hands Of Power Users

HANDS ON
by Richard Hale Shaw

You don't have to be a programmer to create applications for *Microsoft Windows* 3.0. *ToolBook*, a self-styled "software construction set" from Asymetrix, is designed for anyone who wants to create *Windows* programs, ranging from the simple to the complex. The $395 package is as easy to use as a paint program, requires no experience with traditional programming languages, and makes it a cinch to build applications that integrate graphics, hypertext, and animation.

What kinds of applications can you build with *ToolBook*? Prototypes, *Windows* front ends to databases, vertical applications that can integrate text and graphics, courseware and training packages that require animation—the list is almost endless. But because of the performance issues, you'll probably want to avoid using *ToolBook* for time-critical applications such as communications programs unless the application code is contained in a Dynamic Link Library (DLL) written in C.

The programs you create with *ToolBook* can be distributed royalty-free. Since every copy of *Windows* 3.0 comes with a runtime version of *ToolBook*, you'll have a ready-made installed base that can use your *ToolBook* applications.

ToolBook is object oriented in the sense that the programs you create are composed of objects that perform actions. *ToolBook* applications are organized in files called "books," with three levels of password protection and multiple pages. Each page has a foreground and a background composed of buttons, fields, graphics, and "hotwords," which are hypertext links to other pages, books, and objects.

You can create an object easily by selecting it from a palette, drawing it with the built-in color-drawing tools; or pasting in clip art or scanned graphics from the *Windows* Clipboard. Since each object exists in its own layer, you can overlap objects or group them to act as a unit. And, since a page can share a background with other pages, building screens and images requires a minimum of overhead and effort.

Each *ToolBook* object has properties that control its appearance and actions. For instance, you can link one object to another, so that a user's mouse click will cause the object to call (and optionally, return from) another one. Each object can have a script associated with it that dictates the actions *ToolBook* will take when a user points to or selects the object.

You write *ToolBook* scripts in the program's OpenScript programming language, which offers an English-like syntax. For example, to initialize a variable, salesForecast, to 100, you would write "put 100 into salesForecast." *ToolBook* sports script editing and debugging windows for OpenScript programming.

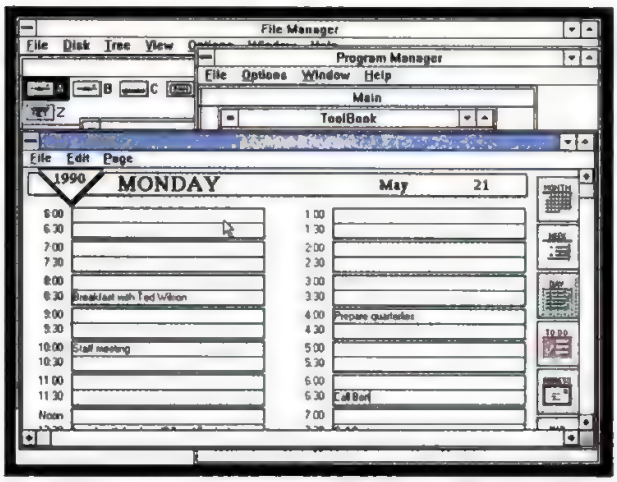
But you don't have to write OpenScript code to create *ToolBook* applications. Most of the job can be done by modifying an object's properties (via a Properties Dialog) and by using the built-in script recorder. The latter will record nearly every *ToolBook* operation (including object movements), allowing you to animate any object. Thus, you can write your own scripts, or *ToolBook* will generate them for you.

ToolBook doesn't limit you to the 100 commands and functions built into OpenScript. You can define your own functions, or access any functions found in any *Windows* DLL. This lets you extend *ToolBook* indefinitely since you can create your own DLLs. A number of these are provided in the package, including interfaces for using *Windows* Dynamic Data Exchange (DDE) and accessing *dBASE* files.

ToolBook comes with several ready-made books, including the DayBook, a daytimer/personal organizer; QuickTour, an on-line guide to *ToolBook*; an Animation Primer; books of script and page ideas and clip art; reference books for using the DLLs; a hypermedia tutorial; a calculator; and the BookShelf, a book that catalogs all the rest. You can modify and copy these books, and can paste their scripts into books of your own. (In addition to a runtime version of *ToolBook*, *Windows* 3.0 includes two books—the DayBook and Introducing *ToolBook*.) As if the program wasn't already easy to use, a pop-up command window is available for issuing OpenScript commands directly.

As for performance, *ToolBook* isn't a speed demon—but it's not a hog, either. Books run at an acceptable speed (depending on the operation involved, of course), but they're not as fast as *Windows* applications written in C. This isn't a serious problem, but it's the one spot where Asymetrix could still improve this otherwise excellent product.

By putting a sophisticated yet easy-to-use development environment in the hands of power users, *ToolBook* may go a long way toward determining the direction that applications development will take in the next decade. Whether you're a skilled *Windows* developer who wants a tool for rapid prototyping or a power user who wants to create *Windows* applications quickly but with little or no programming, *ToolBook* will fit the bill. ■



In addition to a runtime version of *ToolBook*, *Windows* 3.0 comes with two books. Shown here is the DayBook.

FACT FILE

ToolBook
Asymetrix Corp., 110-110th Ave. NE, #717, Bellevue, WA 98004; (206) 637-1500.
List Price: $395.
Requires: *Microsoft Windows* 3.0, 640K conventional memory and 256K extended memory (1.5MB total recommended), hard disk with 2MB available storage (8MB recommended), mouse, EGA or VGA monitor, DOS 3.1 or later.
In Short: A complete *Windows* 3.0 development system designed for power users and developers alike. Provides a point-and-shoot environment for using standard controls, graphics, and hypertext in *Windows* applications; a full-featured programming language; and animation facilities. A must for anyone writing *Windows* applications.

CIRCLE 443 ON READER SERVICE CARD

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CIRCLE 299 ON READER SERVICE CARD

Microsoft Moves Into Forefront of Project Management with Project for Windows

By Henry Farsko-West

Microsoft Project for Windows is so much better than Microsoft's character-based version of *Project* that there is little use comparing them. But there is a great deal of value in comparing this new $695 project management package to the best programs in its price range, because *Project for Windows* has brought together almost all their best features in one program. *Windows* (especially Version 3.0) gives *Project* ease of use and beauty, a rich set of project management features gives it power, and customizable project views make it flexible.

In this combination view, *Project for Windows* displays a Gantt chart in one pane (top) and a PERT chart in a second.

Project for Windows offers just about all the tools you'll need to manage tasks and resources. An outliner lets you arrange tasks in hierarchical order, first by defining the main phases of a project and then honing in on detailed tasks. You can attach a variety of link constraints to tasks as well as set priorities and durations down to the minute in work or elapsed time. A Group Entry and Group Link icon allows you to assign resources, update progress, or assign task links as one operation, even to a group of nonsequential tasks. The program also has resource calendars and boxes in which you can type notes; it supports multiple projects, accommodates overtime cost rates and resource and WBS codes, handles resource leveling and resource-driven scheduling, and on and on.

Project makes the most out of the interactivity of the *Windows* graphical environment, allowing you to manipulate data on screen in a way that complements the visual nature of project management. For example, you can drag the task bars on a Gantt chart to increase duration, or stretch and pull the elements of a PERT chart into more understandable shapes. (The program comes with a runtime version of *Windows*.)

Scroll bars are also used to their best advantage by the program. For example, in the default project view, which combines a Gantt chart with a task-entry form, five scroll bars let you move independently through the Gantt table area, the bar chart, the resource list for a task highlighted in the Gantt table, and its predecessors list. Thus, you can see a great deal of task information at once without changing screens.

Project really shines at giving you flexibility in designing combination views of a project. These split the screen horizontally to display two standard views (out of ten) of your choice. Some of these views are graphic, like the Gantt and PERT charts; some are spreadsheets, like the Task Sheet and Resource Sheet; and some are forms. Thus, you might display a Gantt chart in the top window and a Resource Usage spreadsheet below it. The bottom window shows detailed information for the highlighted task in the top pane.

Combination views come into their own when you use them in conjunction with table and filter commands to control the amount and kind of data displayed in a view. The table commands let you choose the data fields in a spreadsheet. For example, in a task sheet you might choose to display only the task ID, name, percent complete, remaining duration, and actual cost. You can specify such details as the width of the columns and their arrangement, titles, and the alignment of the data within the cells.

Filters let you refine the displayed data even further. If you're working with resources, you can show only those resources that are overbudget or overallocated or that are in a group or ID range you've specified. A filter can have multiple criteria connected by an And or Or operator, and can include interactive or calculated criteria.

You can save the views you've created with table and filter commands and put them on the View menu. What's more, you can save a group of tables, filters, and views in one file so that people at a company can always work with the same set of views.

Project for Windows allows you to print views of Gantt and PERT charts, resource histograms, resource sheets, and resource usage as they appear on screen, but it can only print the active view of a combination view. The program also offers five canned report formats, which can be copied and then edited. You can customize your output by selecting table, sort, and filter criteria as well as by setting headers, footers, and legends and using color, fonts, symbols, shading, and borders.

In the way of project management features, *Project for Windows*' oversights are few. It won't accommodate OBS codes, it can't handle more than one level of zoom on the PERT chart, it lacks the ability to split resource assignments, and it doesn't support the start-to-finish dependency relationship.

Speed is another issue. Although *Project* gains ease of use and beauty from *Windows*, it pays a price in performance. Thus, you'll find *Project for Windows* to be noticeably slower than most character-based project management packages.

Still, *Project for Windows* is a stunning product that moves Microsoft into the forefront of project management. You won't go wrong with this one. ■

FACT FILE

***Microsoft Project for Windows*, Version 1.0**
Microsoft Corp., One Microsoft Way, Redmond, WA 98052; (206) 882-8080.
List Price: $695; upgrade from earlier version of *Microsoft Project*, $99 until June 30, 1990, $195 thereafter.
Requires: 1MB RAM (2MB recommended); hard disk; EGA, VGA, IBM 8514, Hercules or other *Windows*-compatible high-resolution graphics adapter; DOS 3.0 or later; *Windows* 3.0 recommended; Microsoft-compatible mouse recommended.
In Short: *Microsoft Project for Windows* combines the beauty of the *Windows* graphical interface with a rich set of project management features and reliable views.

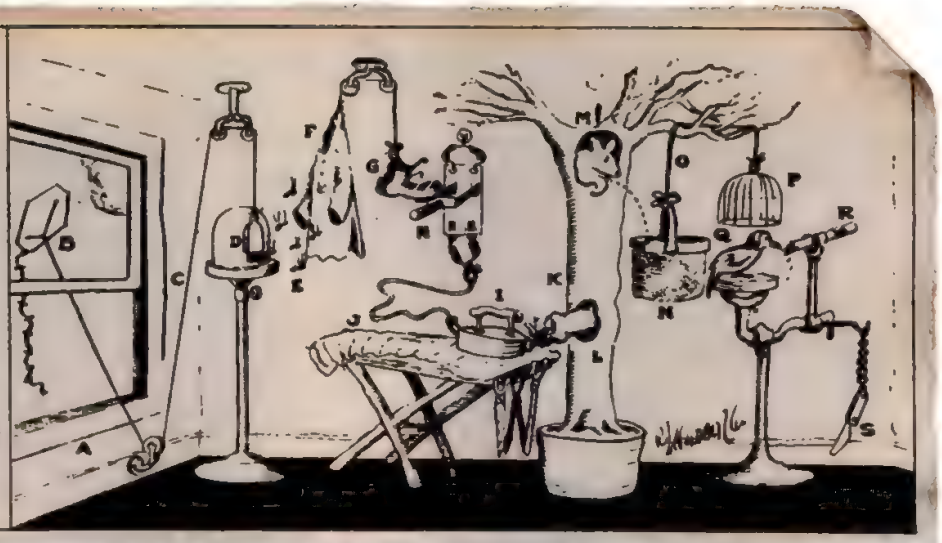
CIRCLE 446 ON READER SERVICE CARD

SIMPLIFIED PENCIL SHARPENER
by RUBE GOLDBERG

PROFESSOR BUTTS GETS HIS THINK-TANK WORKING AND EVOLVES THE SIMPLIFIED PENCIL SHARPENER.

OPEN WINDOW (A) AND FLY KITE (B). STRING (C) LIFTS SMALL DOOR (D), ALLOWING MOTHS (E) TO ESCAPE AND EAT RED FLANNEL SHIRT (F). AS WEIGHT OF SHIRT BECOMES LESS, SHOE (G) STEPS ON SWITCH (H) WHICH HEATS ELECTRIC IRON (I) AND BURNS HOLE IN PANTS (J).

SMOKE (K) ENTERS HOLE IN TREE (L), SMOKING OUT OPOSSUM (M) WHICH JUMPS INTO BASKET (N), PULLING ROPE (O) AND LIFTING CAGE (P), ALLOWING WOODPECKER (Q) TO CHEW WOOD FROM PENCIL (R), EXPOSING LEAD. EMERGENCY KNIFE (S) IS ALWAYS HANDY IN CASE OPOSSUM OR THE WOODPECKER GETS SICK AND CAN'T WORK.

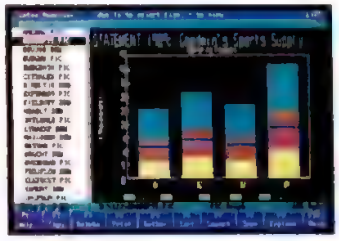


Considering the way most utilities function, you have to wonder where the designers got their inspiration.

They sure didn't get it from us.

The idea behind new Lotus® Magellan® 2.0 was simple. Namely, that people who need a utility shouldn't have to suffer for it.

So, instead of daunting interfaces and convoluted commands, Magellan supplies you with all the functions you use most. In a way that lets you use them faster and easier.



Magellan's viewing screen says a lot about Magellan. simple, uncluttered and easy to understand.

For example, to call up a file when you can't remember the name, just type in the word, phrase or concept you need to find. Magellan will come back with a list of relevant files in seconds, arranged according to how well they match the search criteria.

View each one as it actually appears in its application, even if it's a graphics file. Find the right file and launch the application with a single keystroke.

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All of which is why *PC Magazine* said, "Magellan could well be the finest utility ever written for the PC." And why every major computing magazine has given it practically every award they have.

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*Competitive utilities eligible for upgrades are Norton Commander,® Norton Utilities,® PC Tools,™ Fastback,® XTree,® XTreePro™ and Mace Utilities.®

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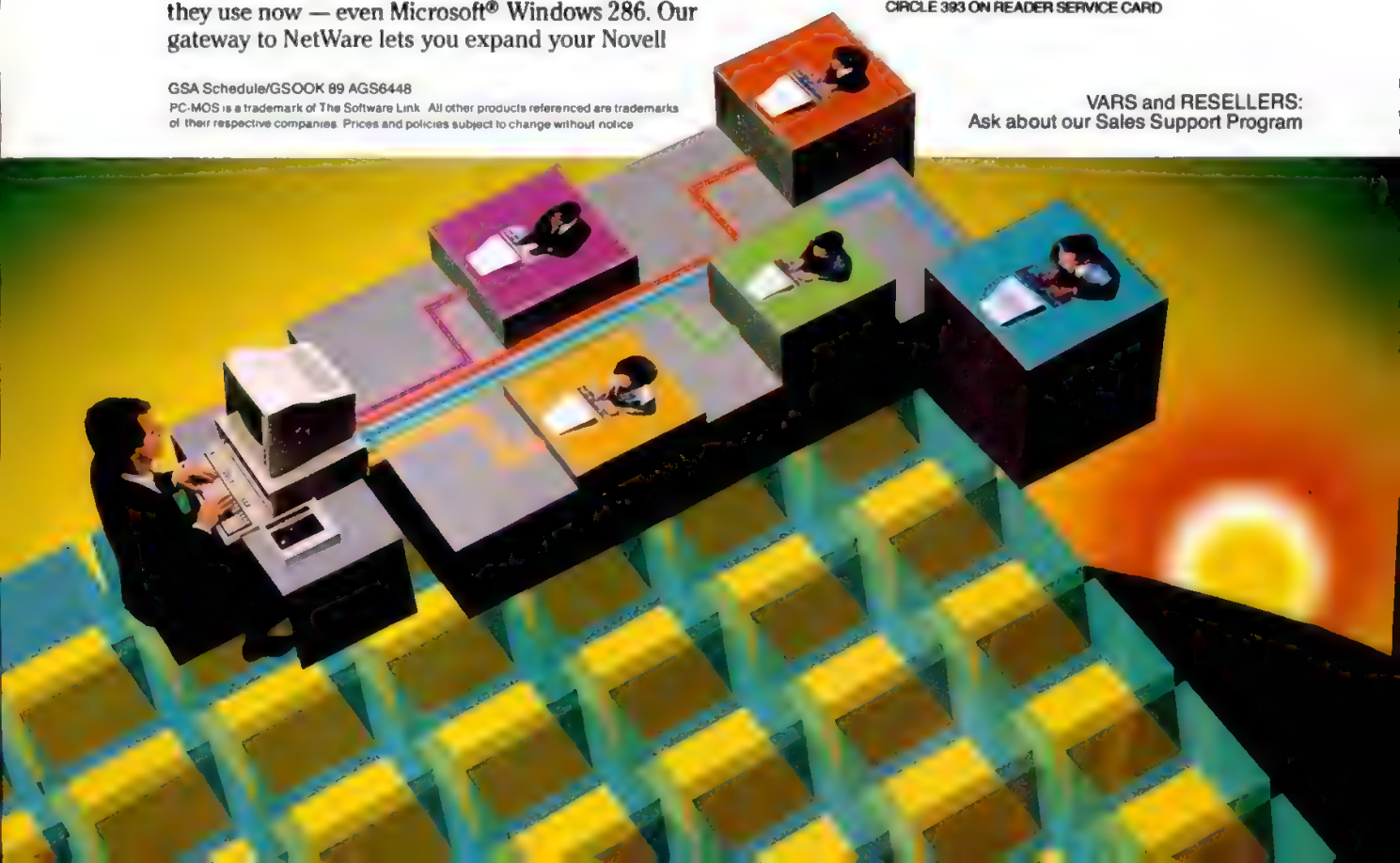


Low-cost SQL-based Query Tool Delivers Data in Tables, Graphs, and Histograms

HANDS ON
By Richard Hale Shaw

Time and time again it has been demonstrated that software doesn't have to be expensive to offer a lot of functionality. YSC Tech's *Query*, Version 2.2, certainly falls into that category. The $88 program uses a healthy subset of SQL (with support for SELECT, UPDATE, and DELETE, as well as expressions using DISTINCT, FROM, WHERE, ORDER BY, GROUP BY, and HAVING) to query *dBASE* files, and delivers the results in tables, reports, graphs, or histograms.

Query operates on database and index files generated by *dBASE III*, *III Plus*, and *IV*, including the latter's .MDX multiple index files. Not only does it let you store and retrieve queries by name and reuse them through its customizable menu system, it also lets you construct queries from pull-down menus via its interactive interface. The program even supplies a shell, so you can issue SQL SELECT commands from the DOS prompt or from inside of another program.

Query's table queries can join two or three database files at a time, a procedure that's similar to *dBASE*-style relations. You can edit the results from a movable, sizable window that holds one record per row, and designate read-only and calculated fields, locked columns, and column colors. You can sort or group the results, and specify your own headings, footers, and totals. A pop-up editor is available for editing memo files.

While you can insert new, blank records in the database, *Query* will not update any indexes if you change the contents of key fields. You can save the query results in a new *dBASE* file, or generate instant histograms and graphs with the touch of a function key.

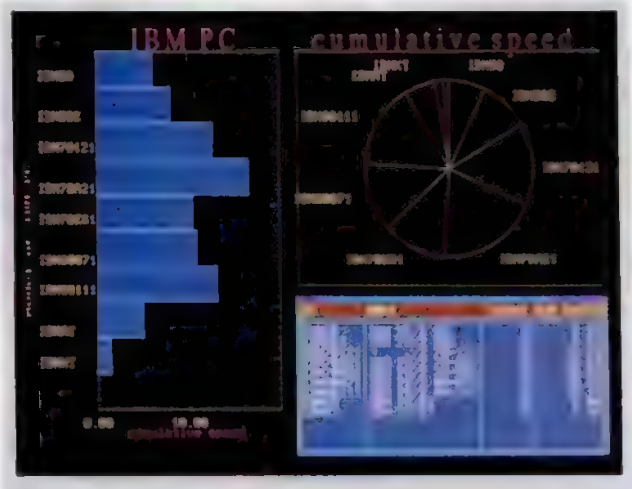
Query will also let you retrieve query results in reports and forms that can be printed, displayed on the screen, or saved to a file. Forms can display fields from multiple databases with one record on each screen.

Reports, which present a read-only view of the data, must first be designed with the report editor. They can include headers, footers, multiple levels of subtotals, and crosstab summaries. The report editor offers facilities for omitting blank lines, controlling color, and manipulating laser printer fonts. Since *Query*'s reports can display a record on several lines, or more than one record on a line, you can also use them to create mailing labels.

Query excels at creating graphs and histograms of query results. The former are standard *x,y* graphs, where the plotted value is a simple field or a complex expression. When you generate a graph, *Query* switches the display to graphics mode, which supports nearly every kind of monitor except CGA. Graph types include bar, stacked bar, and pie charts. You can embed text legends in them, add titles, select the data point symbol and color, add free-form text, and rotate the axis of a graph. While scaling is automatic, a manual override is available.

To create histograms, *Query* takes a range of values from a database column and breaks them into categories; then it produces a total for each category. Each record can contribute either a value of 1 or a weighted amount to the category.

While it will always allow you to create queries on the fly, *Query*'s most powerful feature is its ability to store and reuse a query once you've defined it. These are stored in a database table, sorted by a name you supply and a description. You can select and rerun a stored query at any time, regardless of the form in which the results are returned. *Query* also can build a menu from a table of menu headings and subheadings. You can run *Query* from a batch file, program, or the DOS prompt, and have it display a customized menu where each selection invokes a query or a graph. Thus, you can make *Query* an extension of a custom application, and users need never know they are using it.



Query can deliver query results in both tables and graphs, as shown here.

You can purchase versions of *Query* for either DOS or OS/2, but the OS/2 version is the better performer. This is largely because of the availability of OS/2's virtual memory and better system resources. While this version is fully compatible with the DOS version, its graphs are incompatible with the OS/2 Presentation Manager. So, you'll have to run the OS/2 version in its own screen group. And while the program will run on a LAN, its multiuser support is primitive, and you'll find it undesirable to have someone editing a database where a query is simultaneously being run.

As it stands, *Query* has only one major flaw: documentation that is poorly written and devoid of diagrams and screen shots. This makes the terminology and concepts more difficult to grasp until you actually exercise that part of the program. Fortunately, the package comes with a number of sample queries. You'll do well to skip the documentation and try these out—they make everything clearer.

This flaw aside, *Query* is a fine tool that you'll want to consider if SQL is your forte. ■

FACT FILE

Query, Version 2.2
YSC Tech, 47 Protea Garden, Willowdale, Ontario, Canada M2K 2W5; (416) 733-0228
List Price: $88 (U.S. dollars).
Requires: Two floppy disk drives or hard disk; monochrome, Hercules, EGA or VGA monitor (CGA not supported); DOS 3.1 or later or OS/2 1.1 or later. DOS version requires 640K RAM. OS/2 version uses 640K RAM in protected mode.
In Short: A useful, well-priced SQL-based interactive query tool that can deliver results in *dBASE* tables, forms, reports, graphs, and histograms, and can store and reuse queries once they've been defined. Despite poor documentation, examples and sample queries make it easy to learn and use.

CIRCLE 446 ON READER SERVICE CARD

Monotype Typeface Library Brings Classic Fonts to PostScript Printers

HANDS ON
by Edward Mendelson

Much of the best in 20th-century typography is the work of The Monotype Corp., the English firm that created Times Roman and other classic faces. Until now, desktop publishers had access to little more than pale copies of Monotype's work. Many of the most popular fonts now in use in PostScript and LaserJet printers share the same names as Monotype's typefaces but lack their characteristic vigor and elegance.

With the release of the *Monotype Typeface Library* by Monotype Typography, desktop publishers can finally use Monotype's originals. Some of these classic faces, like Bembo, Plantin, Poliphilus, and 20th Century, aren't available in any other PC format. Others, like Monotype Baskerville and Times New Roman—despite the name, the original version designed by Stanley Morrison in the early 1930s—are available only in less polished versions, some of them barely recognizable as Times Roman. The *Monotype Typeface Library*, nearly 100 packages of PostScript Type 1 fonts ranging in price from $90 to $265, also includes a healthy collection of script and display faces, and recent designs like Photina.

Compared with many of Adobe's designs, especially the early ones, Monotype's fonts look notably less "homogenized" and simplified. Adobe, for example, has a "Times Ten Roman" based on Linotype's licensed version of Times New Roman that has looser character widths and less-subtle curves than the Monotype version. (Curiously, only the Linotype version retains the curved lower stroke of the italic "z" that Monotype used in 1932 but simplified to a straight line shortly afterward.)

Monotype licenses the Type 1 technology from Adobe, and uses Adobe's software tools to create hinted fonts that will work with any PostScript printer or typesetter that handles the Type 1 format. But Monotype chose not to make the slight adjustments to letterforms that Adobe recommends for the most effective use of hints at low resolution.

For example, Adobe might prefer to realign the nodes of a curve along a vertical axis rather than a slightly slanted one, but Monotype chose to let the curve stay as it was, even if this meant a slight roughening of the edges of a letterform at small sizes on 300-dots-per-inch printers. In practice, thanks to recent improvements in Adobe's hinting technology, any roughening is barely noticeable.

However, when Adobe issues its cross-licensed versions of the Monotype library later this year, you may find slight adjustments to the letterforms for the sake of smoother edges at low resolution. If you use a 300-dpi printer with an early version of Adobe's PostScript interpreter for your final output, you may want to compare the Adobe and Monotype versions to see whether you prefer added smoothness or more exact letterforms. But you can't go wrong with Monotype's version if you get your final output from an improved Adobe interpreter like the one in the new Hewlett-Packard PostScript Cartridge for the LaserJet III (which has the added benefit of the III's resolution enhancement technology), or if you use a service bureau that prints at 1,270 or 2,540 dpi.

Many of Monotype's faces have optional "expert sets" with old-style "lowercase" numerals, true small capitals, ligatures, and fractions. These use the same character set pioneered by Adobe with Adobe Garamond, but which Adobe only provides for its own original designs. Monotype provides expert sets for Baskerville, Bembo, Ehrhardt, Perpetua, and Plantin, with more to come.

Monotype will also provide faces that overcome the major limitation of current desktop technology—the use of a single design for all sizes of a typeface. In hot-metal typography, the proportions of a face were different in large and small sizes. Large sizes used proportionally thinner strokes, and small sizes had a higher x-height (the relative size of lower-case letters like "x" and "a" and the bowls of "b" and "p" compared to the height of letters like "l" and "h").

Sometime in the future, fonts using the Apple/Microsoft TrueType technology (formally code-named Royal) will automatically change proportions at different sizes. Until then, typographers need different designs for different sizes, yet virtually all typeface vendors have preferred to supply a single scalable design. Casual users prefer the efficiency of a single scalable face, but typographers know that the results are inadequate anywhere beyond a narrow range of sizes. To solve the single-design compromise, Monotype has announced (but hasn't yet shipped) supplementary packages designed for small sizes of Times New Roman, and further packages are on the way.

Installing a Monotype package is a straightforward task, although you have to insert a separate program disk for each package rather than use a single program disk for multiple packages, as in Adobe's recent releases. The *Microsoft Windows* installation procedure assumes that you're going to download fonts before using *Windows*.

If you want *Windows* applications to download fonts for you, you'll have to modify WIN.INI. The trick is to add a comma and the name and path of the PFB files (the fonts themselves) immediately after each entry for the PFM files (the font metric file that *Windows* uses internally). A *WordPerfect* driver will be released by the time you read this. Whichever program you use them in, the Monotype fonts will make anything you print look like something worth reading. ■

FACT FILE

Monotype Typeface Library
Monotype Typography Inc., 53 W. Jackson Blvd., #504, Chicago, IL 60604; (800) MONOTYP, (312) 855-1440.
List Price: $90 to $265 per package (four to six fonts per package).
Requires: PostScript printer that reads Type 1 fonts.
In Short: Finally, the original Monotype fonts (some of which aren't available in any other PC format) have been made accessible to desktop publishers.

CIRCLE 432 ON READER SERVICE CARD

Monotype Bembo 12
Monotype Bembo Italic 12
Monotype Bembo Semibold 12
Monotype Plantin 12
Monotype News Plantin 12
Monotype Plantin Italic 12
Monotype Plantin Bold Italic 12
Monotype Twentieth Century Light 12
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Some of the *Monotype Typeface Library*'s fonts, like the ones shown above, aren't available in any other PC format.

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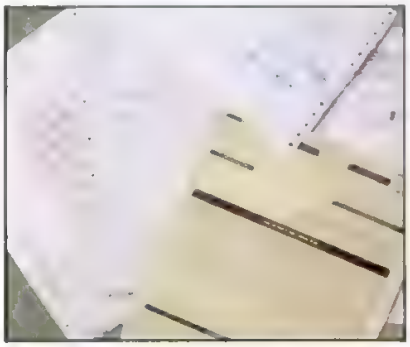

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TEXAS INSTRUMENTS

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First Looks

$299 Authoring System Brings Hypertext to the Masses

HANDS ON
by Robin Raskin

Most people have enough trouble getting their thoughts down in a linear fashion, let alone in hypertext. But if creating documents with hyperlinks to text, graphics, or actions is your goal, *HyperWriter!*—a $299 hypertext authoring program from Ntergaid—will give you the tools you'll need to get the job done.

In large part, *HyperWriter!*'s menus resemble those you'd find in any word processor. An Edit menu handles cut, copy, and paste functions, and a Format menu takes care of tabs, page breaks, and attributes. Two menu options depart from the standard word processing fare: Link lets you mark a block of text for linkage to another block in the document; and Navigate offers different views of your nonlinear text.

HyperWriter! creates three basic kinds of links and many rich variations. Text links can take the form of pop-up notes or new information screens. You can even replace the current text with the new text.

Graphics links establish links to and from any .PCX or .MGR (*HyperWriter!*'s native file format) image. A built-in screen capture utility lets you capture and save screens in the .MGR format.

Action links—the most sophisticated of the bunch—allow a marked block to invoke another DOS program, any internal function of *HyperWriter!*, or any of *HyperWriter!*'s scripting commands.

The scripting commands move *HyperWriter!* into the realm of multimedia. Included are a series of @commands that let you add music, control an external sound source or a Sony or Pioneer videodisk player, or create a report (useful for computer-based training situations in which you want to record accesses to a portion of the document).

HyperWriter!'s navigation tools can provide a flowchart-like map of the hypertext document. They also let you jump to a particular window, tag windows for a return visit, or move to the previous link. A Tour function takes you for an autopropelled journey through the links. A History function displays a list of the names of the last 20 hypertext links that were visited.

Filling out *HyperWriter!*'s repertoire are a spelling checker; a reader's notes feature for annotating text; a search function; bookmarks; and a background feature, which makes it easier to create screens with a uniform look.

To view a *HyperWriter!* document, your audience uses the HyperWriter Reader, a read-only subset of *HyperWriter!* that you can distribute without charge. Surprisingly substantial, the Reader includes all of *HyperWriter!*'s non-editing tools.

Although *HyperWriter!* offers a lot of functionality for the money, the hyperdocuments it produces can have a low-budget look. Primarily, that's because the only font the program offers is the standard Courier screen font in a single point size. Visible links, which are color-coded tab markers (green for text, blue for graphics, and red for actions) and surround a linked block of text, can be distracting. And because it lacks even rudimentary drawing facilities, *HyperWriter!* forces you to use external graphics packages to create boxes, borders, and other design elements.

Still, *HyperWriter!* offers a lot of power, is surprisingly easy to use, and runs efficiently on the entire spectrum of PC machines. If you're looking for a low-cost way of exploring the world of hypermedia, give this program a test run. ■

In this *HyperWriter!* document, green tab markers surrounding the geographic areas indicate links to text. Blue tab markers surrounding Shinto indicate a link to a graphic.

List Price: *HyperWriter!*, Version 2.0, $299. **Requires:** 640K RAM, DOS 3.2 or later, graphics display adapter, 5.25- or 3.5-inch disk drive. Ntergaid Inc., 2490 Black Rock Tpke., #337 Fairfield, CT 06430; (203) 368-0632.

CIRCLE 433 ON READER SERVICE CARD

BOOT.SYS: Shareware Utility Handles Multiple CONFIG.SYS Scenarios

HANDS ON
by Barry Simon

As our environments get more complicated, many of us have begun to collect multiple pairs of CONFIG.SYS and AUTOEXEC.BAT files to address specific sets of working conditions. But keeping track of all those files—just because you don't want to keep a CD-ROM or network driver loaded all the time, or you might not want to run *QEMM* and *DESQview*, or you might want to use Turbo Debugger's 386 mode instead of *386MAX*—can be a hassle in itself.

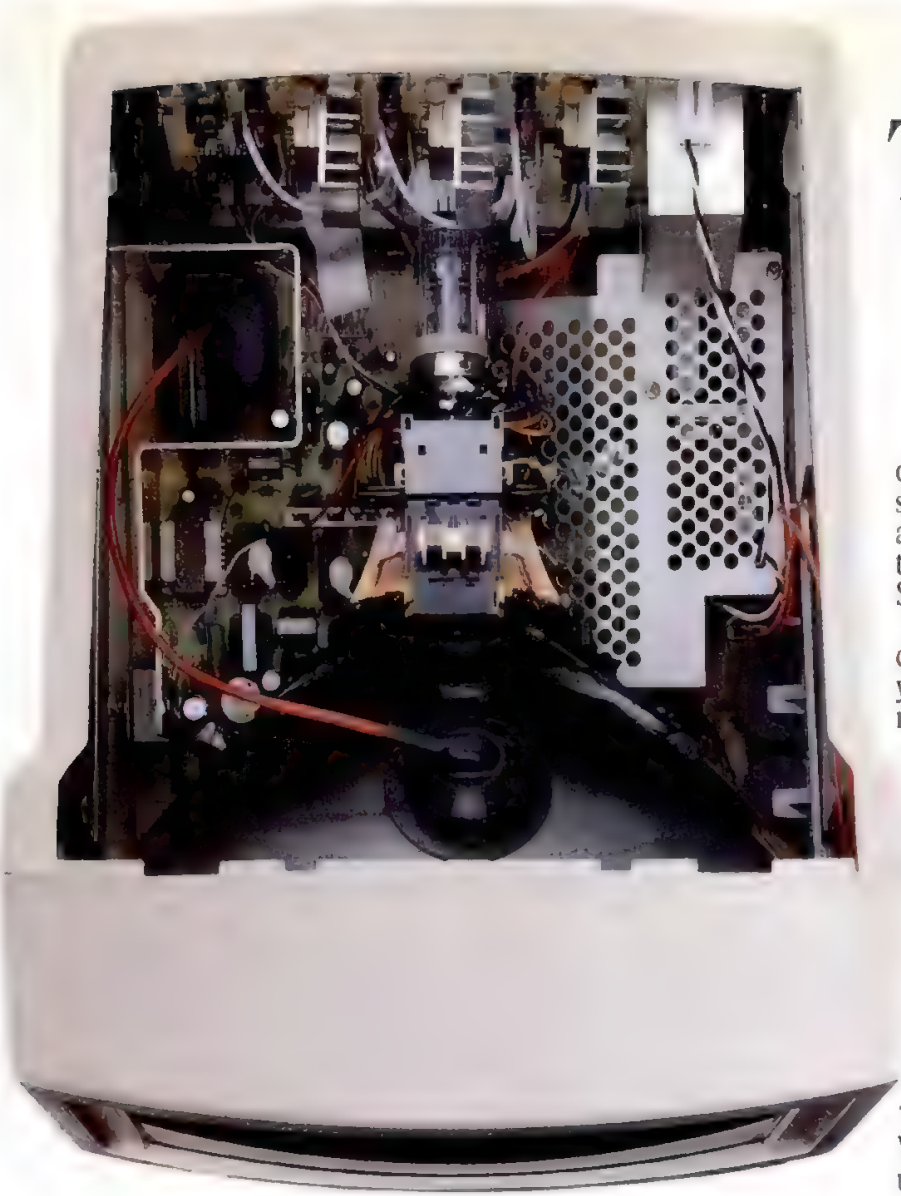
Enter BOOT.SYS, a handy $34 shareware utility that lets you keep all your CONFIG.SYS scenarios in one file, and choose the one you want from a menu. The program also makes your choices accessible in your AUTOEXEC.BAT file, so you can match the commands run there to the CONFIG.SYS file.

Like *PC Magazine*'s CONFIG.CTL utility, BOOT.SYS is loaded as a device driver and processes lines between its load and a matching BOOT.END line. But BOOT.SYS goes way beyond CONFIG.CTL. It lets you post a menu in your choice of colors and have a single key call a whole set of commands. You can have multiple and/or nested menus if you want to make several choices. You can edit selected lines, and each menu can have a default chosen after a stated time.

BOOT.SYS leaves a small device driver in memory. A BOOT.COM program is provided that returns the menu choices in the error level to allow matching flow in your AUTOEXEC.BAT file. If you use multiple boot configurations, you'll find this program invaluable. ■

List Price: BOOT.SYS, Version 1.2, $34 plus $4 for shipping and handling. **Requires:** 256K RAM, DOS 2.11 or later. Hans Salvisberg, Froeschmattstr. 40, CH-3018 Bern, Switzerland; (800) 242-4775 (orders only); (713) 524-6394; CIS PPN (73237,3556).

CIRCLE 430 ON READER SERVICE CARD



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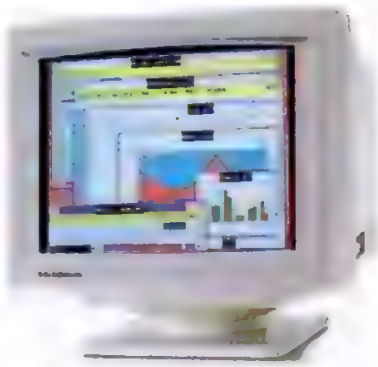
CM-1440	✓	✓	✓	
CM-1450	✓	✓	✓	✓



SII Seiko Instruments Inc

Seiko Instruments USA, Inc., PC Products Division, 1144 Ringwood Court, San Jose, CA 95131, (408) 922-5900. Trinitron is a registered trademark of Sony Corporation. © 1989

CIRCLE 490 ON READER SERVICE CARD

Bounds Checker/Soft-Ice Bring Real-time Breakpoints, Memory Protection to DOS Programs

HANDS ON
By Salvatore P. Ricciardi

Finding subtle bugs caused by memory overwrites can be time-consuming and extremely difficult. But by using features built into Intel's 80386/80486 processors, Nu-Mega Technologies' *Bounds Checker* ($249) and *Soft-Ice* ($386) can help you isolate bugs quickly and more accurately.

Bounds Checker uses the paging mechanism built into the 80386 processor to trap accesses to memory areas your program doesn't own or shouldn't be accessing, such as null pointer writes to the interrupt vector table. The program accomplishes this by automatically building a page map and marking those pages that aren't read and write protected in your program. It also marks all pages that span your code as write protected; pages that span your data and stack area are allowed free access by your program. All memory allocated by your program is also allowed free access by your program.

This technique is applied logically to things like DOS and BIOS interrupts. When a call is made outside of your program, *Bounds Checker* by default switches page maps, so that only your code area is protected. Thus, *Bounds Checker* will not pop up on every DOS or BIOS interrupt, but it will detect errant writes to your program by system software such as TSRs.

Since *Bounds Checker* runs almost entirely in extended memory, it won't work with extended memory managers, such as *386-to-the-Max* or *QEMM-386*. However, it provides its own extended memory manager, which handles LIM 4.0 memory and can load device drivers and TSRs into high memory.

Bounds Checker can use the symbolic information output from your compiler to pinpoint the source code line that is overwriting memory. If symbol information isn't available it uses a disassembly format.

Bounds Checker uses an exception file to determine "valid" accesses to out-of-bounds memory. For example, many programs access video memory directly or read variables in the BIOS data area. These can be specified in the exception file.

Soft-Ice's hardware breakpoint capabilities rival those of more expensive hardware-based in-circuit emulators.

When an out-of-bounds access occurs, *Bounds Checker* pops up and displays the code where the access occurred. At this point you can add it to the exception file if the access is valid, or you can log all information pertaining to the out-of-bounds access to a log file and optionally write protect the memory location. You can also choose to ignore it and continue. The log file serves as a record of all suspect memory accesses.

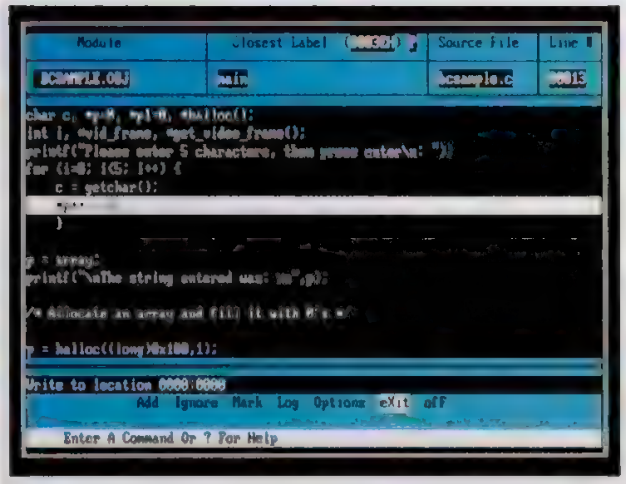
Among *Bounds Checker*'s other options is the ability to transfer control to *Soft-Ice*, Nu-Mega's software-only version of an in-circuit emulator. (Although as of this writing *Soft-Ice* was one release behind *Bounds Checker*, a new version should be available now.)

Traditional in-circuit emulators require expensive hardware that intercepts and monitors all CPU signals. *Soft-Ice* uses the 80386/80486 to provide real-time breakpoints and capabilities usually only available through expensive hardware debuggers.

Soft-Ice's speed and flexibility result from its use of 80386 I/O privilege levels, memory management, and built-in debug registers. *Soft-Ice* uses the processor's ability to handle up to four range breakpoints. You can watch a memory range up to 1MB, and can set execution breakpoints in ROM and on I/O port access. Since *Soft-Ice* doesn't use DOS or BIOS, you can trace through any code running in the system, including DOS, BIOS, device drivers, or even the boot loader.

The only anomaly we found in using these products was their incomplete support for the symbolic information in Borland language products.

Bounds Checker and *Soft-Ice* make sophisticated use of the most powerful versions of Intel's processor family to track down some of DOS programming's most insidious bugs. If you're developing programs for DOS, these are essential tools.■

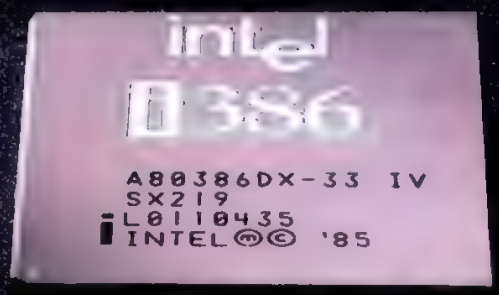


Bounds Checker automatically detects out-of-bounds memory accesses, such as this null pointer assignment.

FACT FILE

***Bounds Checker*, Version 1.0**
***Soft-Ice*, Version 2.1**
Nu-Mega Technologies, P.O. Box 7607, Nashua, NH 03060-7607; (603) 888-2386.
List Price: *Bounds Checker*, $249; *Soft-Ice*, $386
Requires: *Bounds Checker:* 80386, 80386SX, or 80486 processor; 8K conventional memory, 256K extended memory; DOS 2.0 or later. *Soft-Ice:* 80386, 80386SX, or 80486 processor; 256K extended memory; DOS 2.0 or later.
In Short: Two super tools that are a must for DOS programming. *Bounds Checker* automatically detects errors that traditionally take forever to find. *Soft-Ice* provides debugging features that normally require costly hardware support.

CIRCLE 442 ON READER SERVICE CARD



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***InfoWorld*, "We find the ZEOS '386 an excellent value. Speed: Excellent. Compatibility: Excellent. Value: Excellent."**

***Government Computer News*, "Arguably the fastest MS-DOS and OS/2 micro in the world."**

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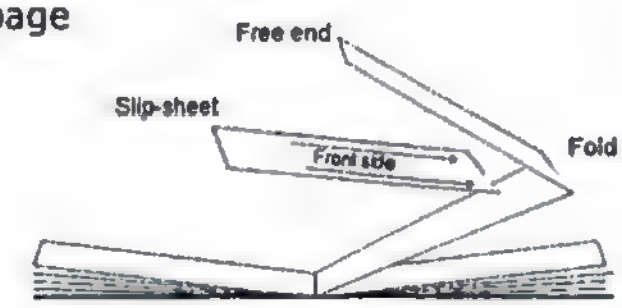
GbsSlipSheet-001

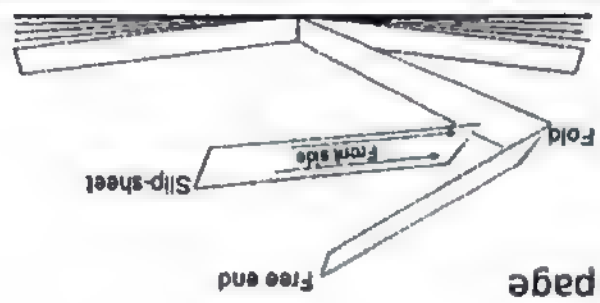
Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



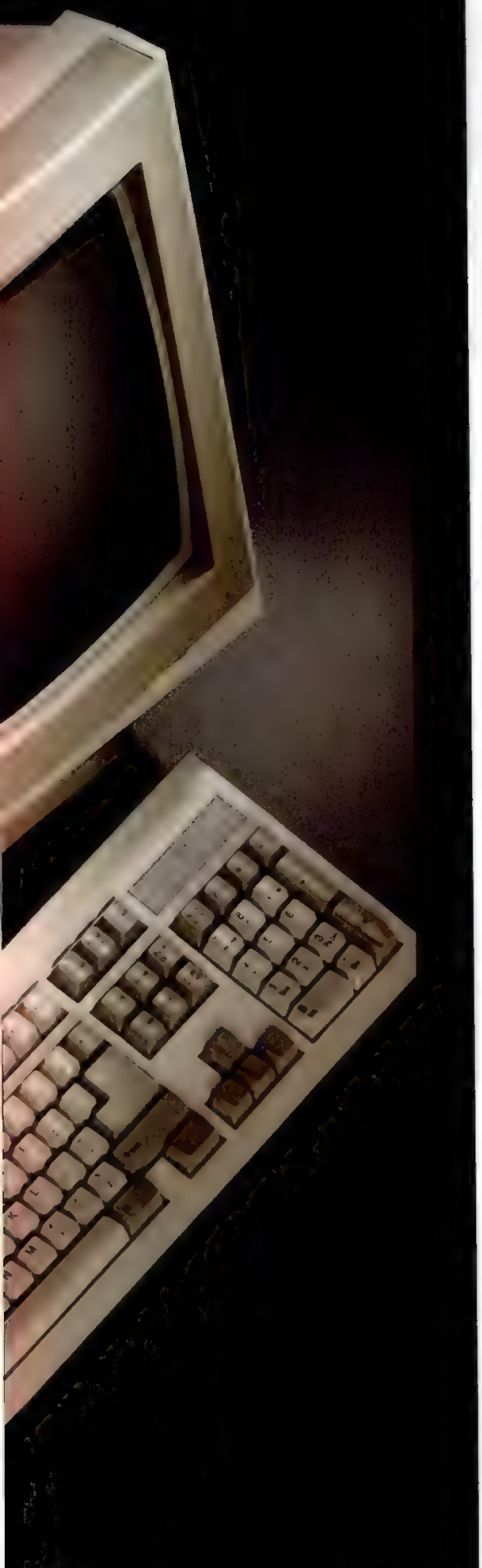
GbsSlipBack-001B

Back

1. Follow instructions on the other side

Inverted Back

1. Follow instructions on the other side



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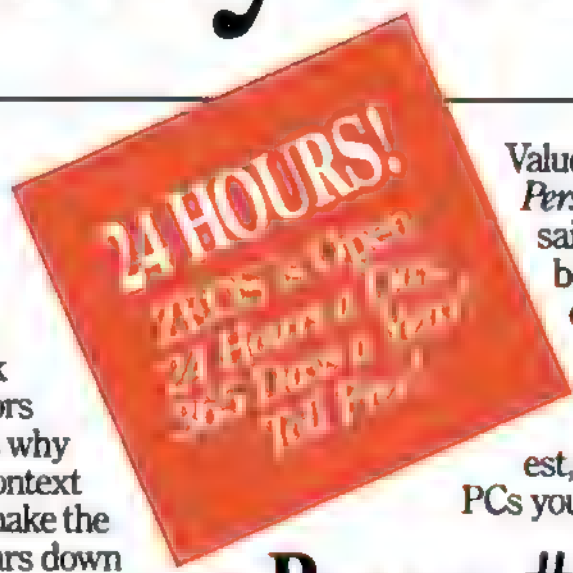

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First Looks

Stackey and Batutil: Ultimate Batch Enhancers

HANDS ON
by Edward Mendelson

Programmers have invented tools to make batch files more flexible ever since the advent of DOS. Some of these tools, notably *PC Magazine*'s BATCHMAN, have helped transform batch file writing from a craft into an art. But no existing set of tools approaches the ingenuity and power of *Stackey* and *Batutil*. The two programs in Ctrlalt Associates' $39 package are as much an artist's palette as a toolkit. Their functions extend far beyond batch files to enhance DOS itself.

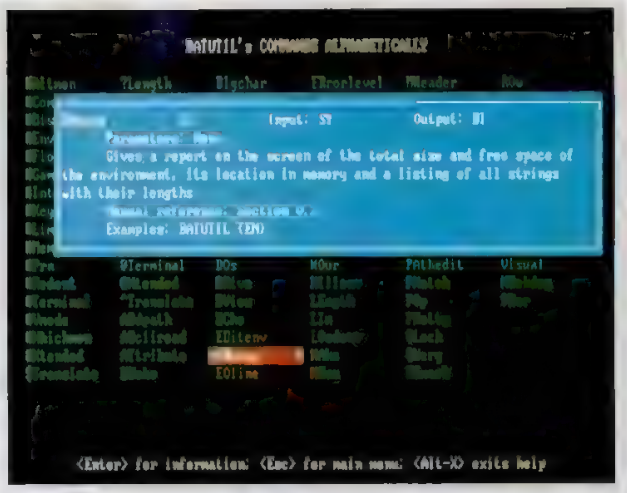
Batutil adds spice to batch files by letting you construct elaborate menus using multiple colors and large letters (constructed from ordinary characters). As you work, you are accompanied by a variety of built-in sounds and tunes. You can easily construct menus with professional touches like a hidden cursor and a highlight that moves with the arrow keys. You can even display a list of files from which a user can point and shoot for processing elsewhere in a batch file.

Using DOS's ERRORLEVEL, you can make batch files that choose different actions according to the type of processor in your computer, the current date or time, the monitor or keyboard attached to the system, the amount of available disk space, or dozens of other variables.

Batutil also gives you effortless control over DOS's environment, and lets you extend your path from the normal limit of 127 characters to 255 characters.

Unlike lesser "keyfake" programs, *Stackey* (the other program in the package) can simulate any combination of keys, lets you pop up messages and accept user input while it plays back keystrokes, and can even pause its keystroke playback until the underlying application displays a specified string.

In addition to managing keystrokes, *Stackey* incorporates "utility" commands that can take the place of many separate utilities that probably clutter your hard disk. These commands include color control, computer reboots, cursor size changes, video mode, VGA and EGA screen lines, lock key control, COM port and LPT port switching, and similar functions.



Batutil includes on-line help for all its commands and functions, complete with cross-references to the manual.

Stackey and *Batutil* come with almost 300 pages of witty documentation and gigantic help files, but the memory-resident portion of *Stackey* fills less than 2K of RAM. If you want to customize your system to automate repetitive tasks, no comparable programs pack more functions into so compact and elegant a package. ■

List Price: *Stackey* and *Batutil*, $39; available as shareware.
Requires: 2K RAM, DOS 2.0 or later. Ctrlalt Associates; to order, contact Support Group Inc., Lake Technology Park, P.O. Box 130, Henry, MD 21541; (800) 872-4768.

CIRCLE 441 ON READER SERVICE CARD

PC Private Eye: The Lightest, Smallest Display You Can Wear

HANDS ON
by Jonathan Mueller

If you want to learn something about the shape of laptops to come, look into the PC Private Eye, a strikingly innovative LED display technology from Reflection Technology.

The $795 CGA-compatible Private Eye is a tiny, rectangular plastic box that is suspended in front of your eye by a headband. When you don the device and gaze into its one-inch-square viewing window, you see what appears to be a standard 12-inch display floating in space before you. The red characters look about as sharp as those on a traditional CRT display, once you focus and position the unit at a comfortable viewing distance from your eye.

Wearing the Private Eye is slightly disorienting at first, because your eyes have not been trained to clearly resolve both the background visible to one eye and the screen image before the other eye. After a few minutes of working with the device, I found that it became steadily more comfortable and familiar. By moving the hinged arm that connects the display to the headband, I was able to lower the viewing window so that it was below my normal line of sight. I was then able to look down at the display, in the same way that I might use a pair of bifocal glasses.

The Private Eye's CGA-compatible display uses an array of 280 LEDs, a magnifying lens, and a reflective mirror to create its crisp red image. The technology doesn't yet support resolutions higher than CGA in two colors. An additional complication arises with the device's inability to coexist on the same bus with a VGA card. In order to install it in my test machine, I had to remove my VGA card and replace it with the Private Eye's proprietary half-length adapter.

Easily the most "personal" PC display ever, the Private Eye simulates a full-sized CGA compatible monitor.

As it stands, the PC Private Eye is more a technology for use by developers or in niche applications than a solution for the common user, and some users will have trouble adjusting to its unfamiliar look and feel. It is a working technology, however, and it will almost certainly have an impact on the design of laptops and other devices that require the smallest, lightest display possible. ■

List Price: PC Private Eye, $795 (substantial discounts available with quantity purchases.)
Requires: One half-length expansion slot. Reflection Technology, 240 Bear Hill Rd., Waltham, MA 02154; (617) 890-5905.

CIRCLE 431 ON READER SERVICE CARD

The Product Is Great, The Price

STANDARD SYSTEM 286/12

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PC MAGAZINE *"Don't pass over the CPU 286 12MHz" —Sept 1989*

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- 1.2MB OR 1.44MB FLOPPY DRIVE
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- 8 EXPANSION SLOTS
- KEYBOARD SELECTABLE CPU SPEED
- REAL-TIME CLOCK/CALENDAR AND BATTERY
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- 384K SHADOW RAM
- 1:1 INTERLEAVE FLOPPY/HARD DISK CONTROLLER
- 1.2MB OR 1.44MB FLOPPY DRIVE
- 101-KEY TACTILE FEEDBACK KEYBOARD
- 2 SERIAL PORTS, 1 PARALLEL PORT AND 1 GAME PORT
- 8 EXPANSION SLOTS
- KEYBOARD SELECTABLE CPU SPEED
- REAL-TIME CLOCK/CALENDAR AND BATTERY
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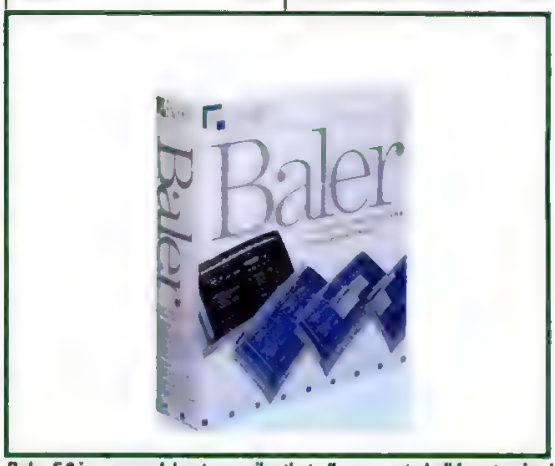

Baler 5.0 is a spreadsheet compiler that allows you to build customized programs from Lotus 1-2-3 files (.wk1). In moments you can take your template and build it into a standalone program with 80 new features from Baler. You can build pull down menus, pop up macros and create up to 1500 pages of context sensitive help screens. $359.

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CIRCLE 205 ON READER SERVICE CARD

by
Matthew J. Ross

New & Improved

News of Announced Products and Upgrades

Compaq Offers Workstations, EISA Token-Ring Controller

NEW

To complement its multiuser server, the Systempro, **Compaq Computer Corp.** has introduced the Compaq 32-Bit DualSpeed Token-Ring Controller and a low-profile 386SX-based PC especially designed for network use.

The controller, an EISA server-based network interface controller, supports 32-bit bus mastering to improve data transfer performance; Compaq claims data transfer to and from system memory in bursts up to 33MB per second. Network drivers bundled with the controller include *NetWare 386*, *NetWare 2.1x* and Microsoft *LAN Manager*. The controller conforms to IEEE 802.5 Token-Ring standards, making it compatible with Token-Ring controllers from other leading vendors.

Compaq's Deskpro 386N integrates a 386SX processor, two expansion slots, VGA circuitry, and a hard disk within its low-profile case.

The 16-MHz 386SX-based Compaq Deskpro 386N is available with a high-density 3.5-inch floppy disk drive, or an additional 40MB hard disk. The system features 1MB RAM expandable to 16MB, two full-length, 16-bit ISA expansion slots, and integrated VGA circuitry in a case 4 inches high. A 12-MHz 80286 version is also available.

List price: Compaq 32-Bit DualSpeed Token-Ring Controller, $1,299; Compaq Deskpro 386N with 1MB RAM, 40MB hard disk, 1.44MB 3.5-inch floppy disk drive, VGA, $3,199; VGA monitor, $699.

Compaq Computer Corp., P.O. Box 692000, Houston, TX 77269; (713) 370-0670.

CIRCLE 435 ON READER SERVICE CARD

HOT PROSPECT

THREE-DIMENSIONAL FASTCAD INCORPORATES PIXAR'S RENDERMAN

Seeking to make three-dimensional modeling easier for CAD users, **Evolution Computing**'s 3-D release of its *FastCAD* software includes features such as hidden surface removal, smooth on-screen animation, and Depth Mode function—which allows you to add a third dimension without entering the elevation. After selecting points in one window, users select the elevation on the Z-axis in a second window to create depth. The program supports up to eight simultaneous views in multiple windows.

FastCAD 3D has also integrated Pixar's rendering language, *RenderMan*, to add textures such as plastic, wood, or marble to objects. In addition, it displays light sources and can cast shadows. *FastCAD RenderMan* uses either .RIB (RenderMan Interface Bytestream) or TIFF file formats. *FastCAD 3D* includes *FastCAD*, Evolution Computing's two-dimensional design package, in addition to the 3-D and rendering packages. The software works with Truevision's Targa and ATVista high-resolution NTSC video adapters for photorealistic imaging, but also supports VGA.

Files rendered within *FastCAD 3D* may be displayed with *FastCAD RenderMan* for realistic shaded and textured objects.

List Price: *FastCAD 3D* with *FastCAD RenderMan*, $2,995.

Requires: 640K RAM, hard disk, math coprocessor, DOS 2.0 or later. *FastCAD RenderMan* requires an 80386 system complete with 80387 coprocessor, and 4MB of extended memory. Evolution Computing, 437 S. 48th St., #106, Tempe, AZ 85281; (602) 967-8633.

CIRCLE 434 ON READER SERVICE CARD

Pacific Data Expands Printer Products Line

NEW

Pacific Data Products is offering a customized version of Brightwork Development's *PS-Print* software to enable networked printers using PDP's PacificPage and Plotter-in-a-Cartridge to function as PostScript or HPGL compatible printers, while still using the printer in its native PCL mode. *PacificPrint* also permits each workstation to print to any printer on the LAN using *NetWare* commands or the included QueueIt! hotkey utility.

In addition, Pacific Data has begun shipping a LaserJet III-compatible 2 Plus 2 Upgradeable Memory Board, which holds up to 2MB of printer memory. The LasetJet III supports two memory boards for a total of 5MB of memory.

List Price: Pacific Data 2 Plus 2 Upgradeable Memory Board, $395 with 1MB, $595 with 2MB; *PacificPrint*, $399.

Requires: *PacificPrint*, 12K RAM per workstation, DOS 3.1 or later. Pacific Data Products, 9125 Rehco Rd., San Diego, CA 92121; (619) 552-0880.

CIRCLE 436 ON READER SERVICE CARD

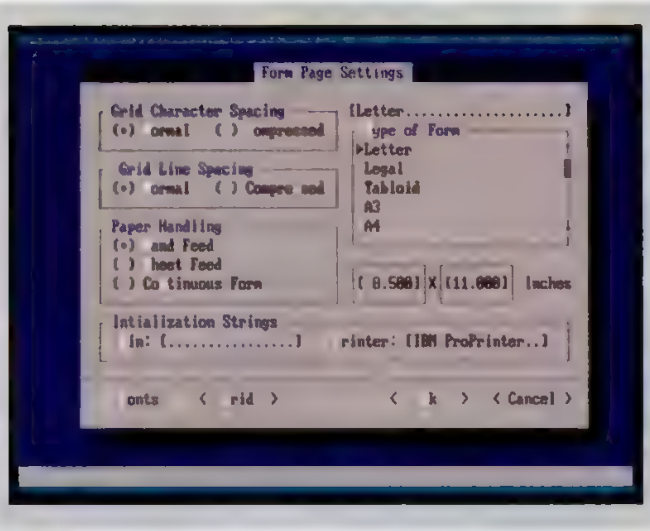
FormType Joins Database with Form Completion

NEW

Easy Automation Systems has combined a relational database and a form creation and fill-in package to create an application that handles both sides of the form processing equation. *FormType* supports input directly from *dBASE* files, and its form layout module can output to preprinted forms directly from popular spreadsheet and database packages while operating as a TSR application. *FormType* captures information to its database as forms are completed. It can also perform automatic math calculations by specifying which form blanks will contain calculations. Network and OS/2 versions are available.

List Price: *FormType*, $149.95, runtime version, $69.95, *FormType LAN Pack*, $695.
Requires: 512K RAM, DOS 2.1 or later. Easy Automation Systems Inc., 5555 Triangle Pkwy., #440, Norcross, GA 30092; (800) 627-EASI, (404) 840-0474.

CIRCLE 440 ON READER SERVICE CARD



FormType can overlay a numbered grid on your form to facilitate form layout and completion.

Gigatek, Tecmar Cram 525MB on Quarter-inch Tape

NEW

Tecmar has designed a high-capacity tape storage system that can hold up to 525MB of data on ¼-inch tape cartridges. The Tecmar QT-525es features a SCSI interface and with data compression can store up to 1 gigabyte of data on a single cartridge. The drive's specified transfer rate is 14MB/minute and is based on DC600 tape technology, so the QT-525es is compatible with existing ¼-inch tape. To support this technology, **Gigatek Memory Systems** is offering 6525-class cartridges and has begun work on a ¼-inch tape format to support 1.3GB on one cartridge.

List Price: Tecmar QT-525es, $3,495. Tecmar, 6225 Cochran Rd., Solon, OH

CONTINUES

IMPROVED

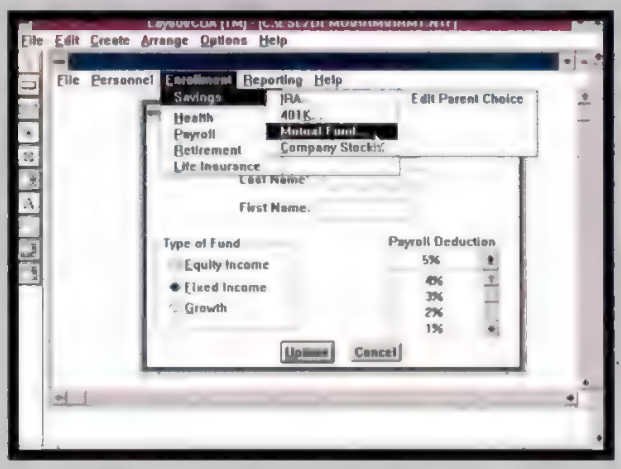
***Lotus 1-2-3*, Release 3.1**—Lotus Development has announced that it will now incorporate PC Publishing's *Impress* technology into *Lotus 1-2-3* to augment the program's graphical capabilities. New features will include: interactive WYSIWYG display and printing, mouse support, advanced worksheet formatting, text editing, graphic drawing tools, .CGM file support, page preview, and publishing quality output.

Lotus 1-2-3, Release 3.1, will support the .ALL file format of Release 2.2 with *Allways*, the .FMT format used by *Impress*, and Bitstream display and printer fonts. Spreadsheet operations will work within the WYSIWYG environment, including adding, modifying, and deleting information and executing worksheet commands. A new virtual memory management system will let users dedicate an area of their hard disk for storage to improve *1-2-3* 3.1's performance on machines with only 1MB of RAM.

Enhanced add-in support will facilitate the use of *1-2-3*, Release 2, add-ins. Release 3.1 will launch from an icon in *Microsoft Windows* 3.0, and users will be able to copy information from the *Windows* clipboard. Release 3.1 will be available in the third quarter. Furthermore, Lotus Development has announced that Release 3.1 is the first step toward providing a full graphical implementation of *1-2-3* under *Windows*. The Standard Edition of *Lotus 1-2-3*, Release 3.1, retails for $595. Users purchasing Release 3 after May 7, 1990, are entitled to a free upgrade; other registered *1-2-3*, Release 3, users will be charged a $35 upgrade fee. Lotus Development Corp., Cambridge, Mass.; (617) 577-8500.

***Easel/2*, Version 1.1**—Interactive Images' application development environment for OS/2's Presentation Manager has added Advanced Program to Program Communications (APPC), SQL Server, and DDE support to its list of cooperative processing application capabilities. Version 1.1's SQL support includes dynamic SQL statements to the database and an interface that handles data formatting, error messages, and direct commands. *Easel/2* works in conjunction with stored SQL procedures and triggers. The Common User Access (CUA) guidelines add several new controls, such as cascading menus, drop-down combination boxes, multiline entry fields, and password fields.

Easel/2 has also added support of digitized sound using IBM's Audio Capture Playback Adapter. Version 1.1 of *Easel/2* retails for $7,500.



Easel/2 has improved its graphical capabilities to include combination boxes and cascading menus.

CONTINUES ON PAGE 56

New Turbo C++ Professional

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*Offer expires July 31, 1990 or while supplies last. Offer good in United States and Canada only. **Special discounts for registered Turbo C® owners are available from Borland. Mail orders to: Borland, P.O. Box 660001, Scotts Valley, CA 95067-0001. For orders outside the U.S. call (408) 438-5300. Turbo C++, Turbo Debugger, Turbo Profiler and Turbo Assembler are trademarks or registered trademarks of Borland International, Inc. Copyright © 1990, Borland International, Inc. All rights reserved. BI-1333

IMPROVED

CONTINUED FROM PAGE 54

with free upgrades available to customers who purchased *Easel/2* 's maintenance contract. Interactive Images Inc., Woburn, Mass.; (617) 938-8440.

***PDC Prolog*, Version 3.2**—The Prolog Development Center is offering an update to *Turbo Prolog* formerly marketed by Borland. *PDC Prolog* includes 50 new Prolog predicates to handle network file-sharing support and expanded editing capabilities. *PDC Prolog*'s built-in editor has been rewritten and can now be embedded within the programmer's application so that programming functions may be assigned to the editor to perform sophisticated text and data handling. A command line feature allows users to compile programs from a batch file without entering the development environment. PDC has begun shipping an OS/2 version of its Prolog compiler—source code compatible with the DOS version—with a pipe system that supports asynchronous messaging independent from the main program. Version 3.2 of *PDC Prolog* for DOS is available for $249. Registered users of *Turbo Prolog* may upgrade for $79 through June 30. *PDC Prolog* for OS/2 includes the DOS version and sells for $599. The Prolog Development Center, Atlanta, Ga.; (800) 762-2710, (404) 873-1366.

***Express Publisher*, Version 1.1**—Power Up! Software Corp. has added support for Hewlett-Packard's LaserJet III printer to its desktop publishing package. Standard LaserJet soft fonts are directly supported by *Express Publisher*, as are the font scaling and graphics functions. *Express Publisher* also uses the LaserJet III's built-in graphics compression techniques and HPGL extensions to reduce printing time. Further enhancements include a "select entire story" option for changing fonts, inclusion of the *Univers* scalable typeface, and support of color .PCX files via black-and-white conversion. *Express Publisher* has a suggested retail price of $149.95. A free upgrade kit is available to registered users and can be obtained by calling (800) 851-2917, or (800) 223-1479 in California. Power Up! Software Corp., San Mateo, Calif.; (415) 345-5900.

***HyperACCESS/5*, Version 1.1**—Hilgraeve's communications package for DOS and OS/2 adds virus protection to its list of features. Using the antivirus filters in tandem with the file signatures of IBM's Virus Scanning Program, *HyperACCESS/5* monitors for 68 currently known viruses. As Hilgraeve obtains new virus signatures, these will be available through the company's bulletin board service.

***HyperACCESS/5* for DOS and OS/2 now includes virus detection of 68 known viruses to safeguard your communications.**

Other features include the Zmodem file transfer protocol, extended hardware buffering (available on the NS16550A serial communications chip found in 386 PCs and IBM PS/2s), shared modems on OS/2 networks, remote execution of OS/2 commands, and improved system settings. Version 1.1 of *HyperACCESS/5* retails for $199. Registered users may upgrade for a $12.95 shipping fee, and an upgrade from *HyperACCESS* is available for $49. Hilgraeve Inc., Monroe, Mich.; (800) 826-2760, (313) 243-0576.

***Ami Professional*, Version 1.2**—The graphical word processor from Samna now offers full compatibility with Hewlett-Packard's object-oriented NewWave environment and *Microsoft Windows* 3.0. Version 1.2 supports dynamic linking among NewWave applications for simultaneous updating of text or graphics among applications; DDE under *Windows* is also supported. Users may designate specific cells in tables as protected to prevent accidental editing, which when combined with the option for printing on ready-made forms give *Ami Professional* rudimentary forms processing capabilities. *Ami Professional*, Version 1.2, carries a suggested retail price of $495. Registered users can receive the upgrade for $10 or $25 with the revised documentation. Samna Corp., Atlanta, Ga.; (404) 851-0007.

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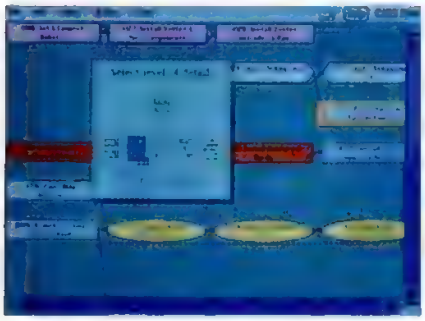
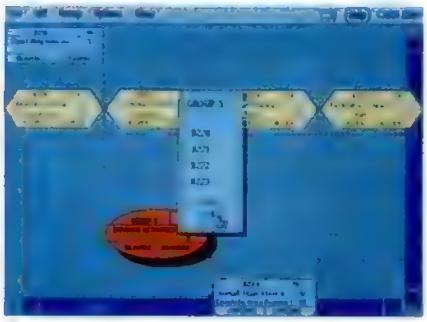
Primavera introduces some important new project management terminology.

Click-Click — use double clicks to add activities, define relationships, and modify activity data.



Zoom — five levels of detail for your network, from bird's-eye to close-up.



Explode — The Collapse command compresses several activities into one; Explode redisplays activities in their original positions.

Pop — highlights all predecessor-successor relationships and lets you click your way along any activity path.

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List Price: Gigatek 6525-class cartridge, $57.73. Gigatek Memory Systems, 1989 Palomar Oaks Way, La Costa, CA 92009; (619) 438-9010.

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Utility Creates TSRs from Clipper Applications

NEW

Black & White International's utility for Nantucket's *dBASE* compiler uses memory management to turn *Clipper*-compiled applications into RAM resident programs that require 13K of memory. *Dr. Switch*—Application Swapping Extensions (ASE) features a cut-and-paste function for exchanging data between *Clipper* applications and other programs; the software supports both expanded and extended memory.

List Price: *Dr. Switch*—ASE, $179.95.

Requires: 640K RAM, hard disk, DOS 3.0 or later. Black & White International Inc., P.O. Box 1040, Planetarium Station, New York, NY 10024; (212) 787-6633.

CIRCLE 438 ON READER SERVICE CARD

ScreenExtender Stretches WordPerfect

NEW

A new screen utility from **Stairway Software** permits *WordPerfect* users to view as many as 60 rows by 128 columns on-screen at once, so they can view entire pages of proportionally spaced documents without scrolling. *ScreenExtender for WordPerfect* 5.0/5.1 supports video standards from CGA and Hercules up through VGA, and displays italics, sub- and superscript, strikeout, double underline, small caps, and bold underline text on-screen. ■

List Price: *ScreenExtender for WordPerfect* 5.0/5.1, $79.95; network version, $120 plus $40 per workstation.

Requires: 42K to 73K RAM, graphics adapter and monitor, *WordPerfect* 5.0 or 5.1, DOS 2.0 or later. Stairway Software Inc., 700 Harris St., #204, Charlottesville, VA 22901; (800) 782-4792, (804) 977-7770.

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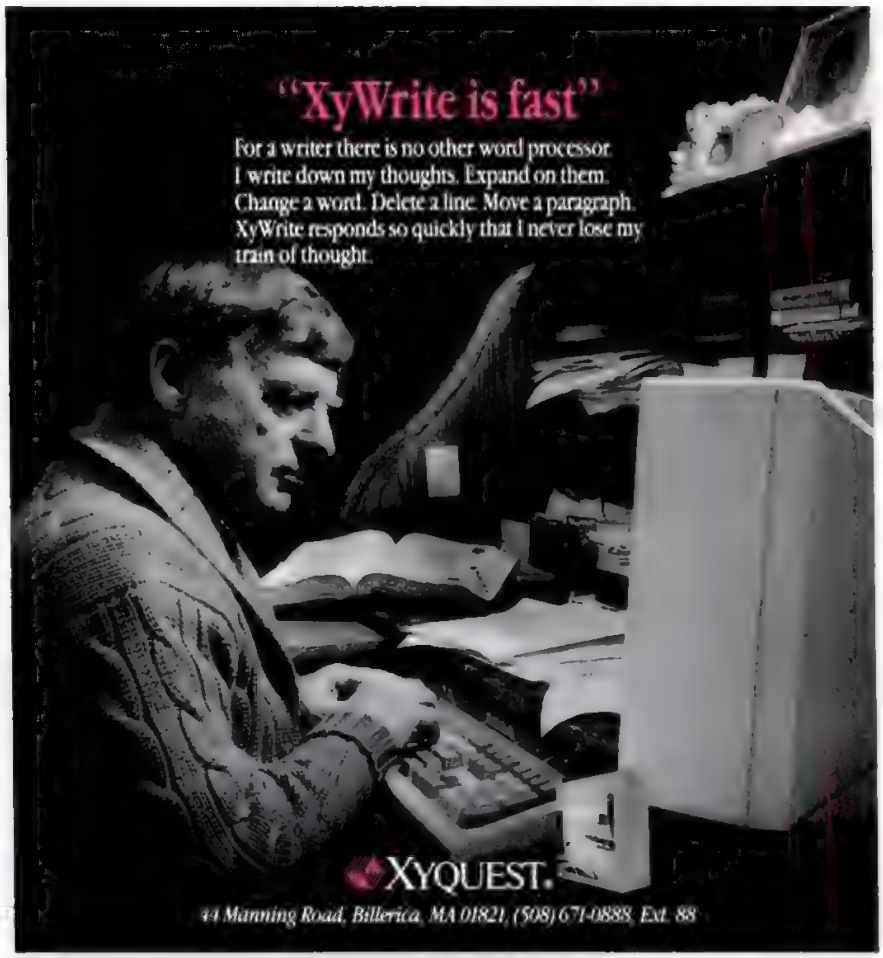
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Sorry, but the no pain, no gain logic does not apply to the new CROSSTALK® Mk.4 Version 2. Simply the most powerful asynchronous communications tool available, plus it has LAN and 3270 capabilities. And it's simply, well... simple to use.

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edited by
Lori Grunin

Read Only

Reviews of the Latest Books for the PC User

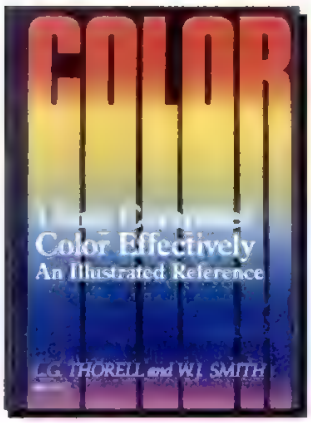
Developing an Educated Palette

■ *Using Computer Color Effectively: An Illustrated Reference*
L.G. Thorell and W.J. Smith
Prentice Hall, Inc., $49.95

Do you know anyone who prefers to watch a black-and-white TV? Neither do I. The public's preference for color screens is evidenced by the rate at which color monitors are replacing monochrome models on the desks of executives, middle managers, and secretaries alike. Though we all may prefer color displays for aesthetic reasons, color can actually increase acuity, clarify conceptual information, enhance performance, and increase retention.

So say L.G. Thorell and W.J. Smith, the two authors of *Using Computer Color Effectively: An Illustrated Reference*. Intended primarily for engineers, programmers, and technical writers, it is impressive in its attempt to cover all aspects of computer color usage. In addition to the standard disciplines that pertain to color perception—optics, physiology, psychophysics, and human factors engineering— this 250-page book deals with the hardware and software specifics of monitors, printers, and video adapters.

Even the most complex sections provide useful information for the average user. But as you might expect, the technical language can be intimidating. Some familiarity with computer hardware will help when you encounter terms like phosphor decay, bit plane, and DAC levels. It will, however, be difficult for a non-engineer to prepare for the



A book that explains why what you see isn't really what you get.

detailed discussion of Gamma correction (which produces a linear relationship between voltage increase and perceived brightness on a monitor) or for the formulas to calculate the chromaticity and luminance of a color mixture using the CIE (Commission International de l'Eclairge) model.

In the final analysis, however, both programmers and designers should know how dithering can create the illusion of more colors with a limited hardware palette, or how anti-aliasing can improve the perceived quality of their text.

For those of us who have been out of the classroom for a few years, *Using Computer Color Effectively* also provides a handy refresher course covering general theories of color vision. You can learn anew the relationship between the physical properties of light (wavelength, intensity, and purity), their perceptual counterparts (hue, lightness, and saturation), and eye structure (position and frequency of rods and cones).

Wanda J. Smith of Hewlett-Packard and Lisa G. Thorell of Sun Computer Systems are ideally qualified to discuss the intricacies of computer color usage, and you won't go wrong following their color usage guidelines. Suggestions include choosing the color sets best suited to representing code-specific types of information: concrete versus abstract meanings, continuous variables, and cause and effect.

In addition to discussing the relation between color and perception, Thorell and Smith also touch on the cultural, and even occupational, color associations that can influence communication. For instance, anyone dealing with foreign clients should be aware that Japanese audiences associate the color blue with villainy—not corporate reliability.

Using Computer Color Effectively is chock full of information that isn't necessarily easy to find or follow. The language is stiff, and editing oversights annoying. For example, the summary table dealing with output devices omits impact printers—although a substantial part of the text discusses them. And, though chapter summaries and extensive bibliographies suggest that this book is meant to be a reference tool, the uneven quality of the index makes such use difficult.

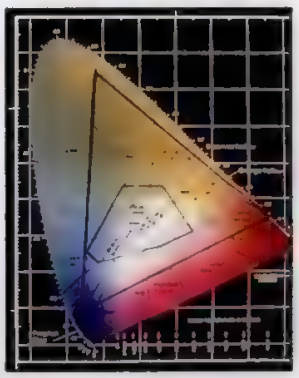
While acknowledging the ephemeral and subjective nature of color perception, Thorell and Smith have nevertheless attempted to catalog and quantify color experience and usage. While noting the occasional failure of *Using Computer Color Effectively*, I must acknowledge the enormity of the task they have undertaken. I know of no other book that combines in one package so much of the information that we—programmers, engineers and end users—need in order to produce meaningful and colorful computer images.

—Luisa Simone ■

Prentice-Hall, College Technical and Reference Division, Englewood Cliffs, NJ 07632; (201) 592-2498.
ISBN: 0-13-939878-3.

CIRCLE 412 ON READER SERVICE CARD

From 16 to 16 Million



Thorell and Smith reproduce variations on the CIE Chromaticity diagram several times in the course of the book, illustrating, for instance, how well a CRT, an impact printer, and a thermal printer can duplicate the range of visible colors. In this graph, the large triangle shows the display limits of a color monitor (in this case, a TV) relative to the visible spectrum. The interior polygon delineates the colors possible with an impact printer. This diagram goes a long way toward explaining why your business graphs never look as good on paper as on screen. (Reprinted by author's permission.)

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CIRCLE 130 ON READER SERVICE CARD

by
Gus Venditto

Pipeline

A Look at the Trends Shaping the Personal Computer Market

Voice Messages and LAN Mail: A Union That's Nearing Completion

Even though PCs are central switching stations for millions of voice mail messages daily, individual users are cut off from any meaningful way to integrate those recordings with other work.

NeXT and Wang have both demonstrated expensive ways to attach voice messages to files that can be sent across a network. For good measure, they usually show the feature at work in conjunction with a spreadsheet and a graphic, to emphasize how the advanced designs of their proprietary systems will emulate all levels of human interaction. Computer files are more than data, they can be a lecture, complete with exhibits.

Projects are in the works that will make voice messages practical on today's PCs without anywhere near the extra expense of a NeXT computer.

The most promising way to bring recorded speech to a PC is with an inexpensive board that will store and synthesize speech that's kept on hard disk files. While there are expensive systems that use lots of memory to handle the encoding-decoding chores and provide complex signal analysis, workable systems are available for less than $200 a board.

The types of system that NeXT and Wang show would be possible using one of these boards under OS/2 and a carefully prepared HP NewWave application—if the requisite drivers and software tools were available.

More likely to be used in an office, however, are simpler systems that do no more than attach voice messages to LAN mail messages.

Using a telephone handset and a standard LAN mail program, you'd start the transmis-

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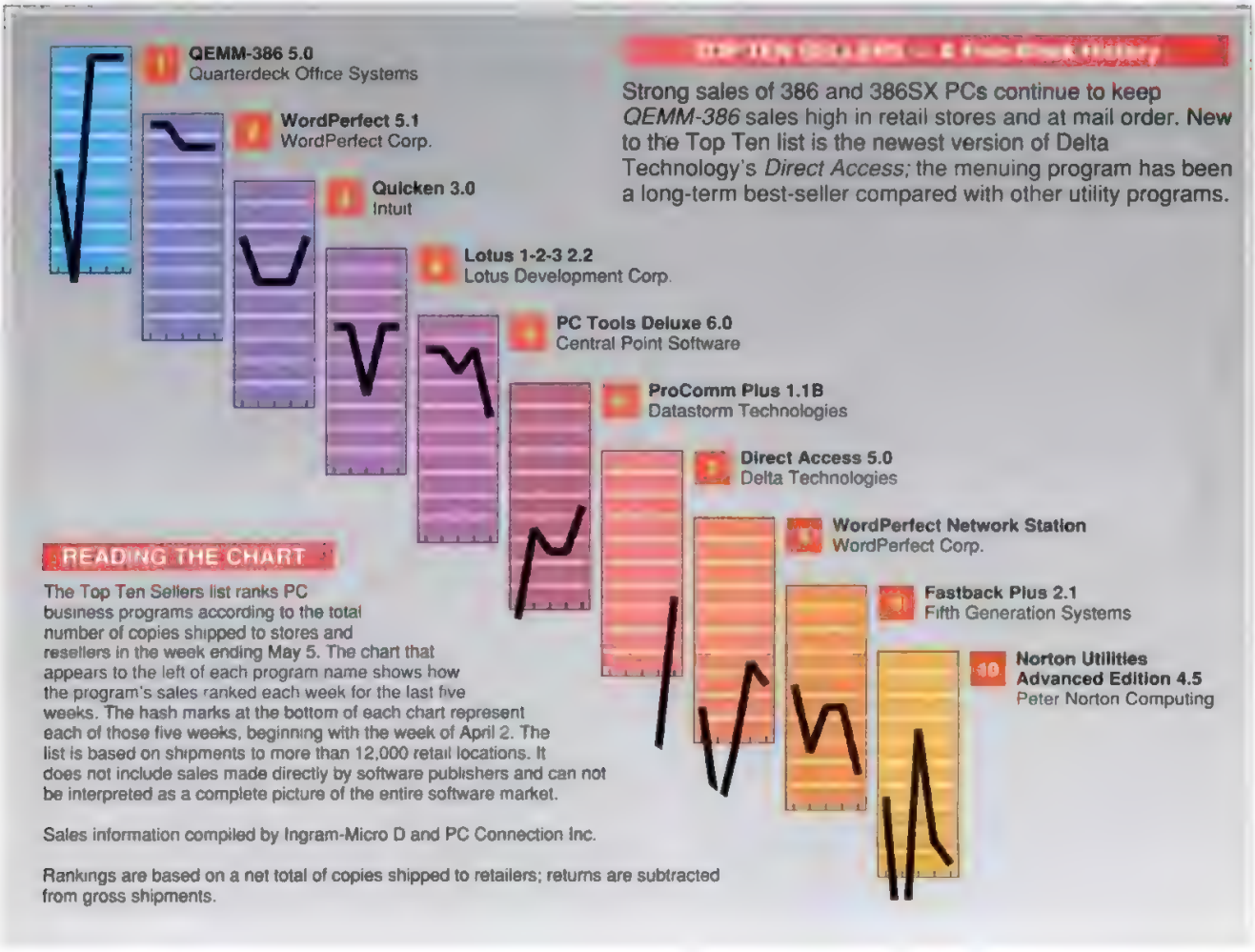


Pipeline

CONTINUED FROM PAGE 63

sion by creating an ordinary message for someone else on the network. Instead of typing out the message, you'd choose a voice option and pick up a phone handset or turn on a microphone to record the message. The voice file would be stored on disk and linked to the message. The LAN mail software would put both files in the recipient's in-box and if the recipient had a board that could convert the recording to sound, it could be played back.

Such a system is available today on the Mac, using LAN mail software from either Microsoft or CE Software, with a voice digitizer from Farallon Computing that plugs into the Mac's serial port and costs $149.

It's a safe bet to assume that publishers of LAN software for PCs will come up with a similar system before the year is out. The add-in board that will make it feasible is VoiceLink from XSI in Reston, Virginia. It's a $249 half-length card that has a modular telephone jack, so you can use an ordinary telephone handset for input and output. Voice Link compresses recordings so that as much as an hour's worth of sound can be stored in 4.3MB.

Simple voice messaging is just a first step toward full integration of speech into data processing. An emerging class of integrated circuit designs called digital signal processors (DSPs) will help hardware designers perfect speech recognition over the next few years.

DSPs provide control over all manner of analog signals ranging from radar to video. Although basic analog-to-digital conversions can provide voice messaging at lower cost, DSPs can provide the sort of sound-wave analysis that can filter out noise, or recognize sound patterns.

> Simple voice messaging is just a first step toward full integration of speech into data processing.

Verbex Voice Systems in Edison, New Jersey, is one of the leaders in using a DSP in a commercial voice-recognition product. Its PC boards are being used by Wall Street traders to translate spoken orders into executable data. Since prices range from $4,000 to $10,000 per board, it's clearly a technology likely to remain outside most companies plans for years to come.

No-frills voice messaging systems that cost several-hundred dollars a user are not going to overtake typed e-mail messages in office communications, but voice attachments could become important elements in an executive information system and in linking networks to people who can't—or won't—master the keyboard. Don't be surprised if a no-compromises voice system is available by year's end.

Compaq Edges Away from the 5.25-Inch Disk

The slow movement away from the familiar floppy is getting another push this summer from the disk's most loyal patron.

After holding the line for years, Compaq has finally changed the primary configuration on its newest systems to a 3.5-inch A: drive, instead of a 5.25-inch drive. It will still offer 5.25-inch disks in various options, and has no intention of relegating floppies to external devices, as IBM did when it introduced the PS/2 line.

Compaq says it's listening to customer demand now, just as it did in 1987 when it held the line against the smaller disks. "We don't burn bridges, we build them," was typical of the advertising slogans Compaq used back then.

Microsoft Claims An Ally in Network Standards War

As of this writing, it was unclear what kind of fallout will result from the collapse of the Lotus-Novell merger. Yet the specter of this combination was clearly influencing strategic planning in the two months when it seemed to be a fait accompli. Microsoft, for one, felt compelled to make a deal with a company that had been a competitor in its bid to sell network operating systems.

In mid-May, executives from Banyan and Microsoft announced their plans to make Banyan's *VINES* and Microsoft's *LAN Manager* compatible. That means Banyan will add *LAN Manager* protocols and programming interfaces to *VINES*, including Server Message Blocks, Named Pipes, and Mail Slot protocols. With these in place, *VINES* workstations will now be able to seamlessly connect with *LAN Manager* servers.

Peter Norton Joins Symantec

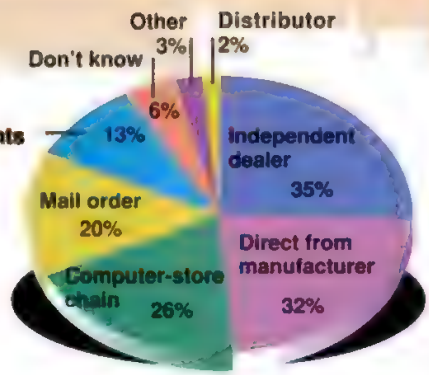
Another pioneer has adapted to the changing nature of the software business. Peter Norton has agreed to let Symantec acquire his company in a stock-transfer deal.

The Norton Utilities, *Norton Commander*, and a brand-new utility program for the Macintosh will now be developed by Symantec in a separate division. In recent years Symantec has acquired a handful of software publishers (Turner-Hall, Breakthrough, and Living Videotext) and runs them as separate divisions.

What Peter Norton Computing needed was to develop a direct sales force to continue to be competitive in the industry. Since Symantec already has a good sales force, and Peter Norton was about to give Symantec a run for its money with a hot new utility for the Macintosh, the deal made sense for both sides. ■

MagNet SURVEY

Where did your company purchase PCs in the last 12 months?



Personal computers have changed the way Americans do business on a number of fronts. Even the way PCs are sold is unique. In a recent survey, 1751 callers to PC MagNet answered questions about the types of PCs they're buying and how they're making the purchases. IBM, Compaq, and Zenith were the leading brands out of several dozen companies cited by respondents; but when we asked people to tell us where they shop, the clear message is that corporate buyers like a range of choices.

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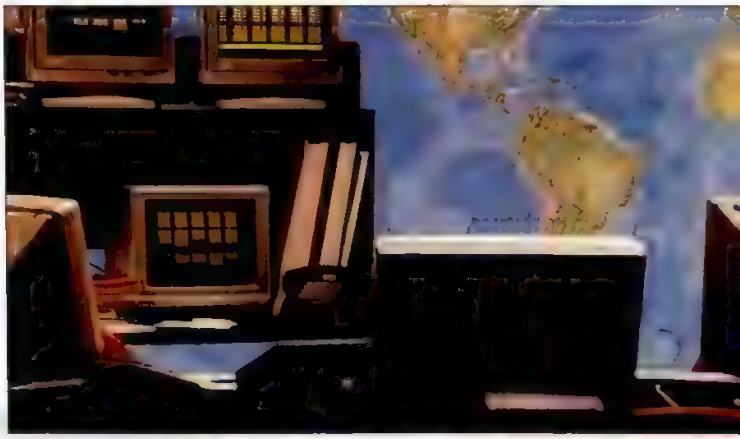

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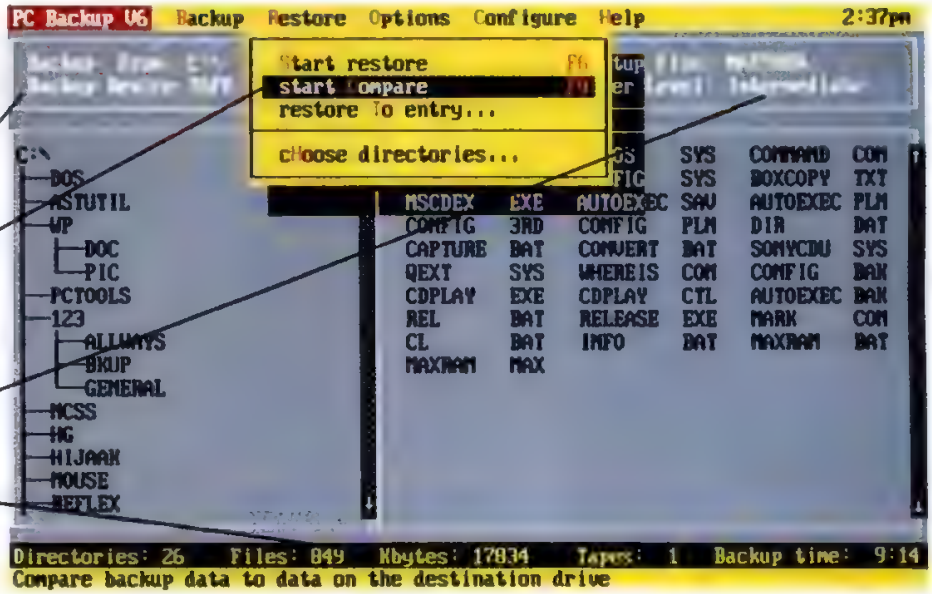

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"...a collection of utilities that you can use from the moment you turn on your computer to the moment you turn it off."
—PC Magazine, Jan. 16, 1990

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Ed Mendelson, PC Magazine "Best of 1989 Awards," January 16, 1990

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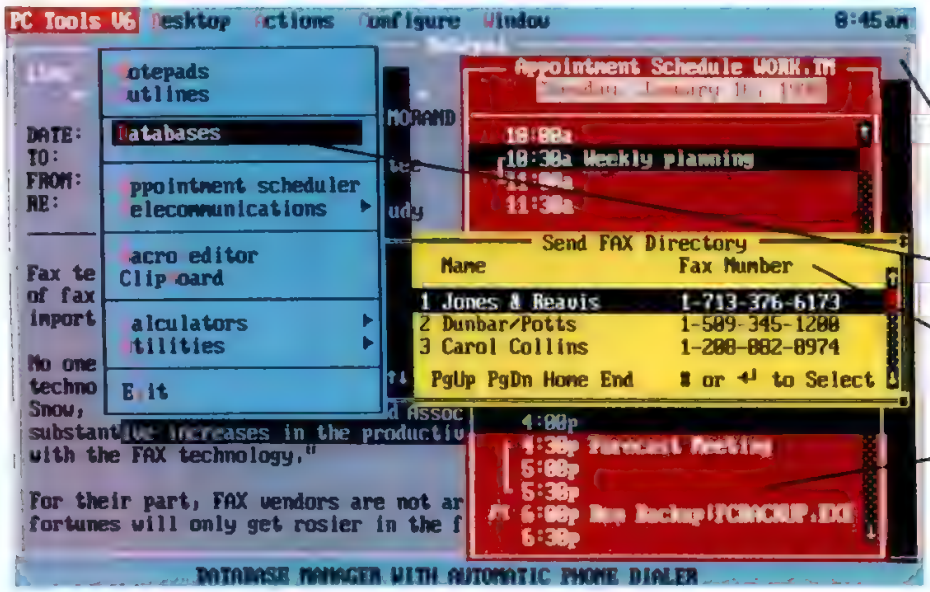

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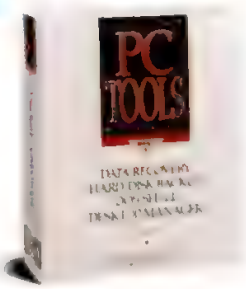

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Bill Machrone

Software Up In Flames

What happens when you lose your investment in software to a natural catastrophe? The answers will surprise you.

I got some e-mail recently from Cathy Konas. Cathy is a director of APCUG, the Association of PC User Groups, a nationwide coordinative body.

"What happens," she wondered, "if a fire destroys your software collection, including your manuals and archival disks? Will the software publishers charge you for an entire new copy?"

She told me this would be an ideal article topic. I agreed, given the unique nature of software: The material costs are low and you've already paid for a license to use the intellectual property. In a further exchange of messages, I basically conned her into doing the research. The results are, in a word, amazing in their variety and inconsistency. Fortunately, Cathy has a large software collection, so her correspondence with the manufacturers is both far-ranging and representative.

Central Point Software responded by telephone with a message that they would simply charge the upgrade fee of $35. Datastorm, the *ProComm* folks, responded with a photocopy of their software license for each product. They sent no note, no further explanation. It has the usual strongly worded disclaimer of all liability, but nary a mention of replacement. Traveling Software admitted it didn't have an established policy, but would use 25 percent of the retail price as a guideline on a case-by-case basis. Ashton-Tate and XyQuest had a different approach—full retail price!

And here's the one you're really gonna love: "...industry practice is such that the license does not in any way survive the destruction of the diskettes. This is why the end-user license agreement specifies that the license is terminable on destruction of the diskette, and why the warranty provisions on the same page expressly limit end-user remedies to the replacement value of the product."

That's the word from Ann E. Fitzsimmons, General Counsel, at that bastion of user-friendliness, Peter Norton Computing Inc. Industry practice? If that's their idea of industry practice, I'm surprised their software isn't copy protected as well.

EMOTIONAL ATTACHMENT

WordPerfect, another otherwise user-friendly company, had the same approach as Norton: full price. But they're willing to assign your old license number to your newly purchased package. Gosh, what a deal. We should be grateful that they recognize our deep emotional attachment to our old license numbers.

On the other side of the coin, Multisoft Corp. wrote, "Since you are a current owner of our product, we do not require you to pay for the licensing as that is what you did when you first purchased the *PC-Kwik Power Pak*."

Lotus Development Corp. came through for users, too. As long as proof of fire or theft is provided, they will replace disks for $25 each; templates, $5; complete set of manuals, $45; binder, $10. Fifth Generation Systems has reasonable replacement fees. Disks are typically $15; manuals, $20; both, $25 to $50, depending on the product and the current revision.

ILLUSTRATION: KAREN STOLPER

To Cathy's question concerning *PageMaker*, Aldus responded somewhat equivocally: "As a one-time replacement service for lost or stolen items, we can offer our registered customers either new disks or manuals for a $50 fee; however, if both disks and documentation are missing, we consider this a full product replacement at the retail price."

Aldus evidently wants you to keep your disks and manuals separate from one another to prove you're not trying to rip them off.

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Bill Machrone

Cathy owns a lot of Microsoft products, eight to be exact. Microsoft was one of the last companies to respond, but had one of the most detailed responses. Basically, if you show them a police report or the insurance form, you can buy replacement disks or manuals at very reasonable prices: $12.50 for a set of disks, $17.50 for the first manual, $2.50 for each additional manual. Microsoft even took the trouble to check and found that two of Cathy's packages were unregistered and said that registration is an important way to protect your rights as a licensee and customer. They suggested that Cathy's insurance company call the customer service department for an explanation of their policies.

THE INSURANCE ANGLE

There's another side to all this. If you're insuring your software, what value do you declare? Nobody pays retail. Does software depreciate in value?

One of the motivations in Cathy's research was to ascertain the manufacturer's replacement value of the software for insurance purposes. The few who bothered to answer cited full retail value. It strikes me as somewhat nonsensical that on one hand the publisher would charge a user-friendly, nominal fee for replacement, yet declare full retail value for insurance purposes. Cathy's insurance company is adamant that the replacement value of the software is the full retail price, despite the policies cited by most of the above manufacturers. It further chooses to ignore reality: even the few products whose benighted manufacturers charge full retail price for replacements can typically be had for half price, sometimes less. Why insure for more than you have to spend? It only drives up the premium with no net benefit. True, it describes the insurance companies' theoretical maximum exposure, but so what?

It's clear that every software company should adopt the policy that catastrophically lost products be replaced at the upgrade price or similar nominal rates. Of course, if they did so, there wouldn't be much of a market for insuring it. In order to protect themselves against fraud, the software publishers certainly have the right to insist that you register the product and show some proof of loss.

The industry needs to get its act together on this one. ■

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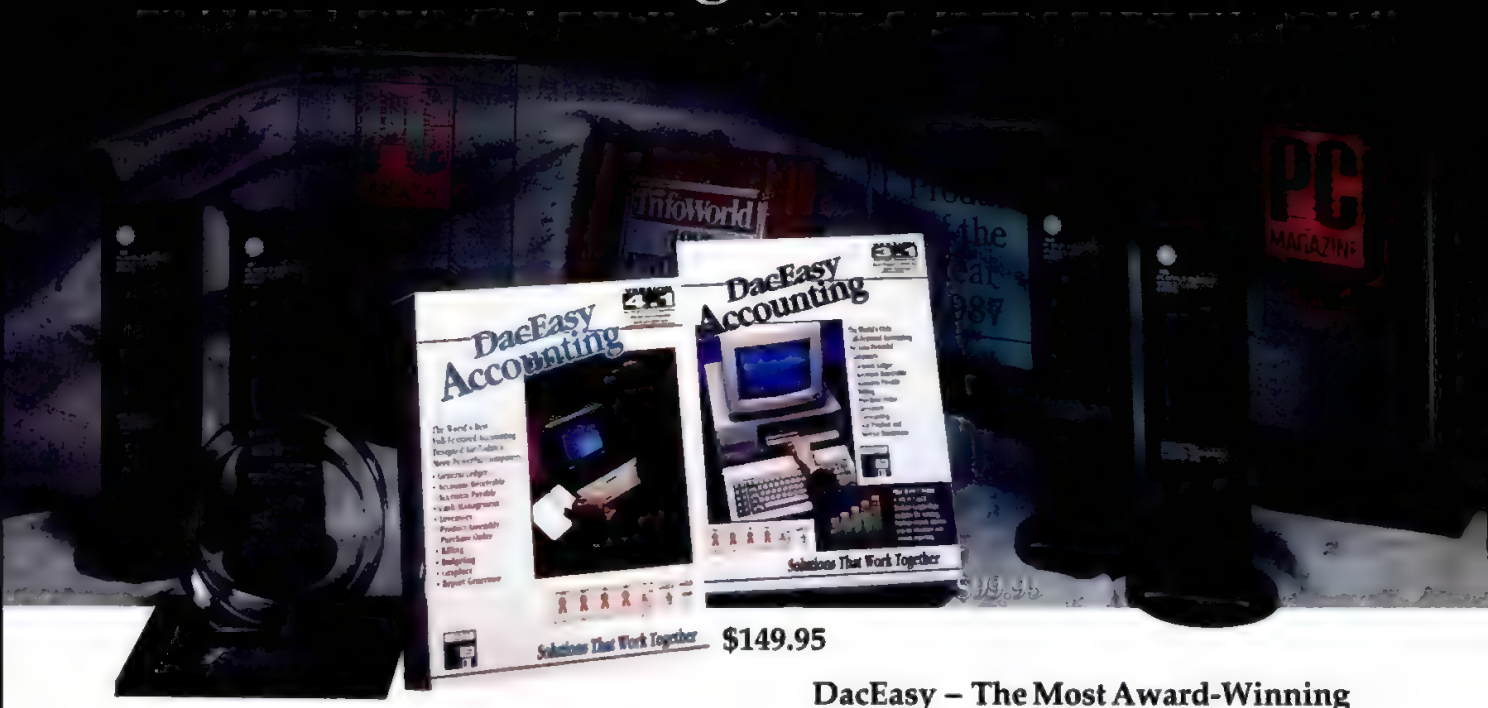

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A mega-corporation for software is just waiting to be born. Is there anyone who can run it?

When talks between Lotus and Novell got serious, arm-waving pundits were trying to find reasons why this was a bad idea. I wasn't about to find fault, since about six months earlier I had written an essay advocating that some of the major firms merge to form what I called MegaSoft Corp. in an effort to keep Microsoft competitive and feisty.

At this time, the only company pushing to become massive is Computer Associates. But there always seems to be something insubstantial about that company, with its concentration on expensive accounting software.

The Lotus/Novell deal combines the number one spreadsheet vendor with the number one networking house. Buried in the bowels of these two companies may also be a kicker or two. If it hasn't already, Novell's network software development group could easily develop an operating system.

Now, if Lotus/Novell could acquire Ashton-Tate and/or Digital Research, we'd have a new ballgame. WordPerfect Corp. has also been mentioned, but that fit isn't so good, since the basic command set and orientation of the WordPerfect line of software are nearly alien to those of Lotus.

Borland would be a good choice for strategic reasons. Its *Quattro Pro* is the most outstanding spreadsheet on the market and it's *Lotus*-compatible. Borland has an excellent languages group and has the potential to create a good word processor. Besides that, the company has *Paradox*, perhaps the finest database manager sold today. Borland, as well as it's doing, could be doing better. It would fit in well with Lotus/Novell.

Another potentially good partner is Symantec, which has database and word processing software as well as languages and utilities in its arsenal. And since Symantec has done *Lotus* add-in software, it has avoided straying too far from the *Lotus*-style interface.

These two MegaSoft candidates share some common denominators that are absent at WordPerfect, Computer Associates, Digital Research, and Ashton-Tate, namely a group of venture capitalists including Kleiner, Perkins, and Sevin-Rosen. These guys cringe when they see how Microsoft does both applications and systems and how it can ride roughshod over the competition.

The venture capital clique has a very strong interest in Symantec. At Borland there is some of the same influence, since *Paradox* was largely a Sevin-Rosen project and Borland let the camel's head in the tent when it acquired *Paradox* from Ansa, the defunct entity that developed it.

A MegaSoft Corp. created by combining Lotus, Novell, Borland, and Symantec would be formidable. Incredible might be a better word. Even products that appear to be in conflict aren't. *Q&A* and *Paradox* are sold into different markets. Borland specializes in PC languages, Symantec in Macintosh languages. All that would be missing would be systems software, which, like I said earlier, may be hidden in there someplace already. If Digital Research could be added to the mix, then the industry might be transformed overnight.

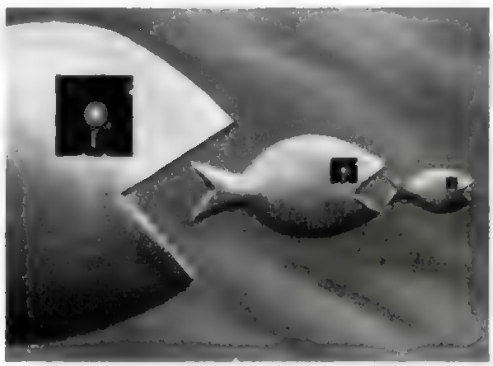

ILLUSTRATION: KAREN STOLPER

But to compete with Microsoft, MegaSoft would still need to come up with one missing element: a visionary. A Bill Gates. Someone who can run the thing.

The industry needs an Alfred Sloan of software to pull it off. Sloan, as you may recall, was the first superstar executive—he made GM a megacorporation. No CEO in any of these software companies is qualified for the job. Unfortunately, it seems that they all think they are.

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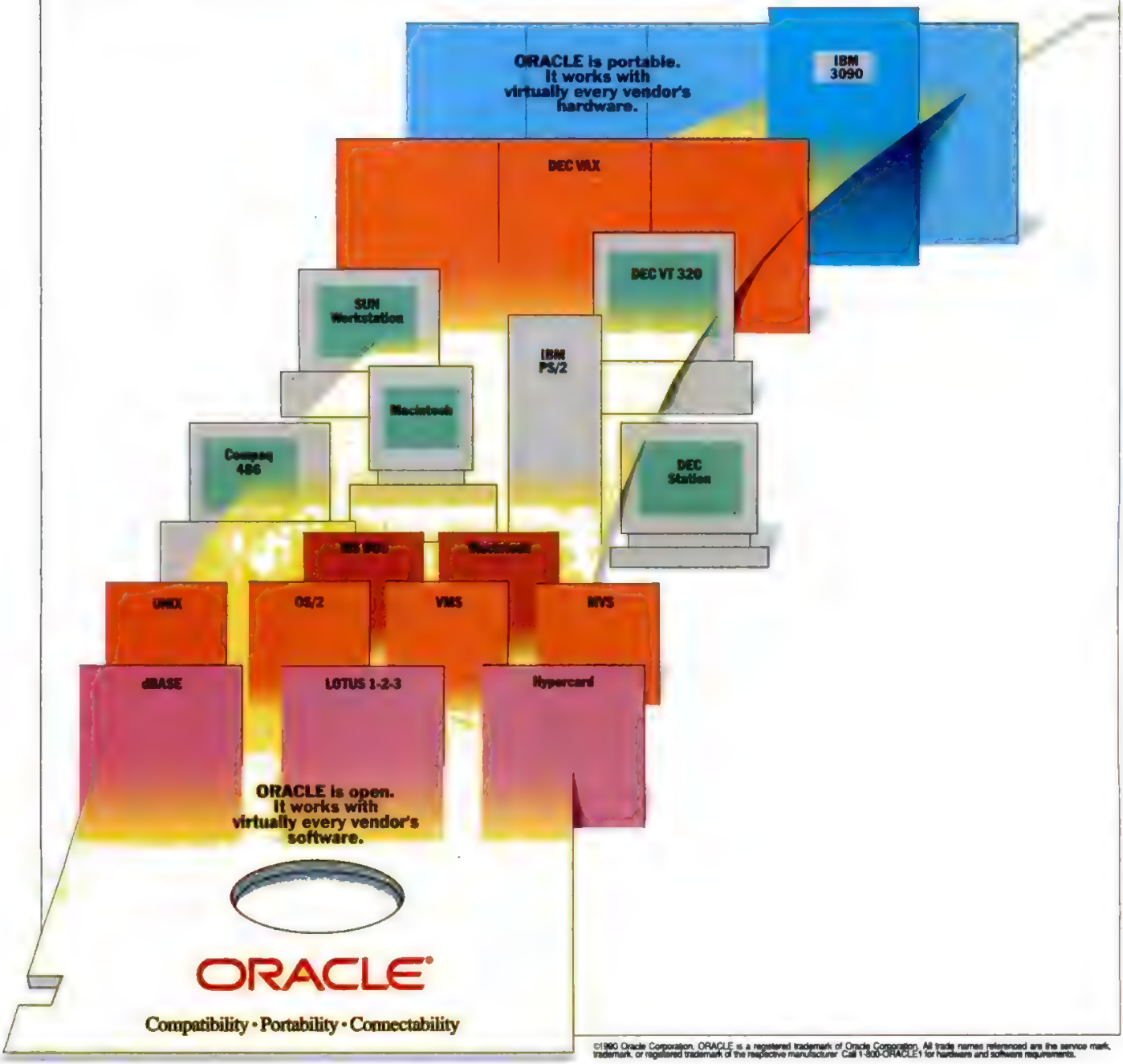

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John C.
Dvorak

Inside Track

The **latest rumor** from the world of *Microsoft Windows* 3.0 is that we can expect to see **Windows on a Chip,** perhaps sold on a card to be inserted into an AT slot and possibly becoming an "instant-on" device. If done right, a device like this would be a boon to *Windows* users. The thought of rebooting an elaborate disk-based *Windows* system is enough to make your **teeth itch.**

While I'm sure such a device would immediately be dubbed "*Windows* on a Shingle" by cynics, it may be the answer to **nagging performance issues,** especially if DOS is also parked on the card. As a few of you know, Microsoft has finally released a **ROMable version of DOS** to compete with the ROMable version of DR-DOS, the DOS clone from Digital Research.

This brings us to the idea of putting **OS/2 on a card,** too. This would eliminate all the moaning and groaning about memory. It would also **simplify** the installation process, which involves far too many disks to be practical or fun. This installation complaint holds true for *Windows*, also. Too many disks. Too much time. Too many questions to answer. A plug-in card and a single disk would help things.

> The thought of rebooting an elaborate disk-based *Windows* system is enough to make your teeth itch.

On the **PC MagNet Dvorak forum,** Walter Dnes went one further with the idea by suggesting the invention of an **OS/2-oriented ASIC.** "Since the OS/2 interface shies away from CPU-specific calls, how about designing a chip with (at least) some of the OS/2 API in microcode to try to get the one instruction per CPU cycle ratio that is desired."

Other Chip News Dept.: I was amused to see an announcement for a 20-MHz Z-80 delivering **5 mips** of processing power. I suppose that if we were still running all that tight assembly language Z-80 code today this would be the equivalent of 486 performance. Maybe we all didn't have to **feverishly hustle** off to 16- and 32-bit microprocessors. Too late to go back now.

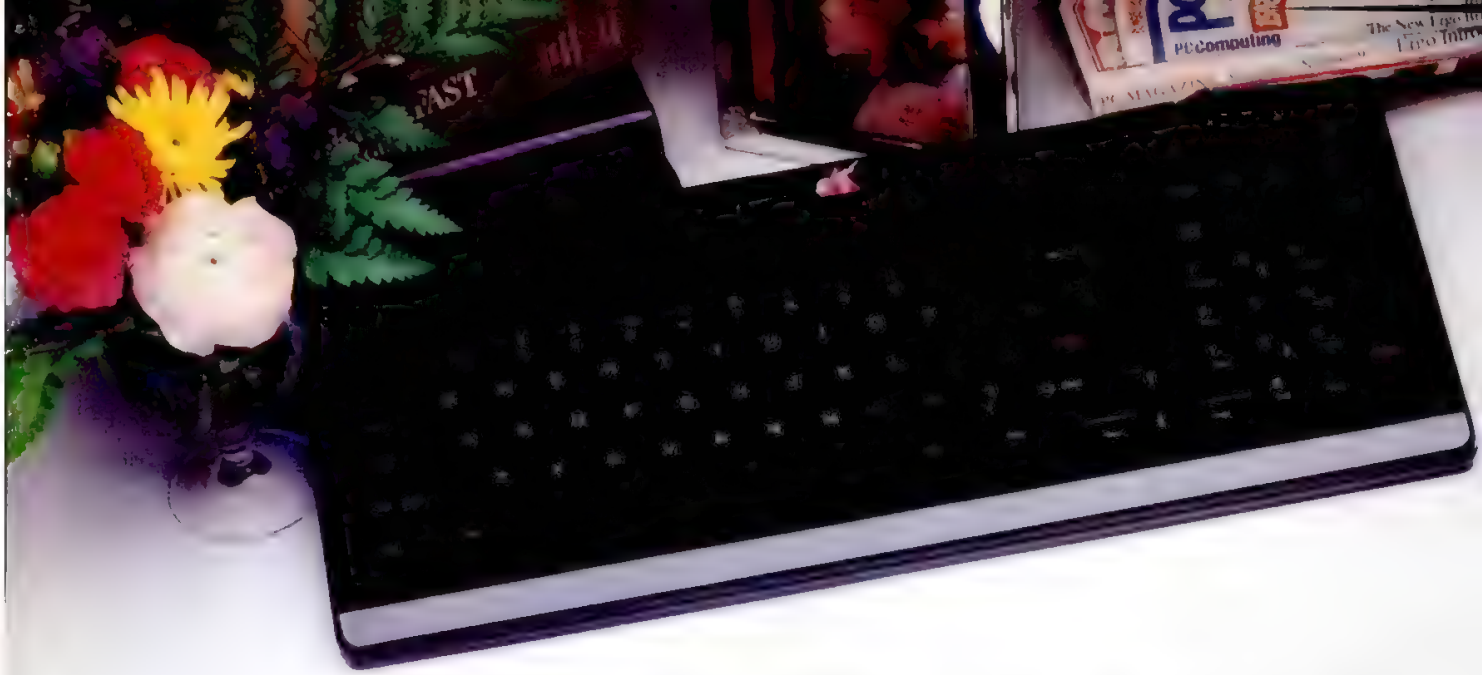
Genuinely Interesting Software Dept.: I have so much stuff in my machines that I sometimes have to swap out the CONFIG.SYS or the AUTOEXEC.BAT files to gain more memory or to load some **unusual drivers** that I don't always want in the system. When I return to my regular system I reload the old stuff from backups, reboot and I'm back to work. Needless to say this procedure is a **pain** in the buttocks, so I was happy to see *Bootcon* from Modular Software Systems (115 W. California Blvd., #113, Pasadena, CA 91105; (818) 794-7602). This $59.95 utility modifies your CONFIG.SYS file so that it branches to any number of CONFIG/AUTOEXEC options. To order *Bootcon*, contact Programmer's Shop (800) 421-8006 or Programmer's Connection (800) 336-1166.

Up to 26 different configurations can be selected at boot time from a menu that appears on the screen. It works great. It even adds password protection if you want it. Best of all the company offers a **30-day money back guarantee,** so if you have an odd system that doesn't like the software, you can get a full refund. Highly recommended. And except for the fact that the install program color combo can't be seen on some LCD screens, this program has a **slick install** front end that other vendors should examine.

Genuinely Interesting Hardware Dept.: Someone has finally invented a modem that isn't much bigger than a db-25. **Not even needing a battery,** the Stowaway 2400 modem (Vocal Technologies of Santa Clara, California; for the sales office call them at (203) 356-1837) uses the RS-232 power from the computer to run the AT command set then switches to the phone line power to run the modem once connected. The list price for this **engineering marvel** is $295. This is the smallest standalone 2,400 bits-per-second Hayes-compatible modem ever! Its batteryless operation is a big plus for people on the road. I had a 9-volt battery go out on a Worldport modem once. I lucked out to discover that the TV remote controller in my hotel room had a 9-volt battery in it, otherwise I would have been in trouble. Anyway, the Stowaway is the **niftiest and smallest portable modem in the world.** It should set a new standard.

While on the Subject of Small Modems Dept.: Those of you with the new **Compaq LTE** should take a look at the newest Holmes Microsystems **9,600 bit-per-second fax modem** that installs right inside the LTE (with models available for nearly every laptop; call them at their Salt Lake City headquarters at (801) 975-9929). This full-featured $699 fax modem includes a Hayes-compatible 2400 baud modem in addition to the fax modem, which can both send and receive faxes. These guys make the **best** in-board laptop modems, period.

BBS of the Month Dept.: When you get that modem online, you might want to call some of the computerized bulletin boards around the country. This month I looked at The Compact Disc Exchange. The BBS number is (415) 824-7603. These guys use a bulletin board system to broker new and used **compact audio disks.** If you have disks to sell or if you want to buy some obscure disks, then give this particular BBS a look. ■



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The Brick fits in half a briefcase, leaving room for everything else you have to carry.

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high memory, and still leave the lower 640k free. The regular Brick shown above also accepts an internal ISA 16-bit half length card, while the "Stretch Brick," shown at right, accepts one full and one half length card.

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Jim Seymour

Lotus/Novell: Where's the Beef?

The jokes are fading, but the apprehension many network managers feel about the Lotus/Novell merger is far from over. Are their worries justified?

This is a business, software publishers will tell you, where Big is Good, and Bigger is Better.

Blind application of that so-called principle remains the most plausible explanation, after two months and thousands of lines of analysis, of Lotus's decision in April to acquire Novell in a stock-swap.

Most of the jokes over funny names for the combined effort—from "Lovell" to "Notus" to "L'ell [With You]" to my favorite, No Lo (a term one wag insists will soon be the stock response of the legal department of the new company)—are dying down now.

But if the bad jokes are fading, the apprehension many network managers feel about the merger is far from over. That apprehension grows out of Lotus's sorry record in producing truly networkable software.

With the sole and very recent exception of *Notes*—a brilliant product that exists *only* as a network program—it's hard to think of a major application software company that seemed less responsive than Lotus to LAN managers' needs, less interested in understanding those needs, less interested even in *learning* about networkable products.

Now, network administrators groan, Novell is part of that company.

The motives behind the union of these two companies are hard to divine. By combining two half-billion-dollar companies, Lotus and Novell will produce a billion-dollar behemoth, which will then be nipping at the heels of industry-leader Microsoft in terms of gross revenues.

SURVIVAL OF THE BIGGEST

As the big guys gobble up small fish, there is something to be said for bigness. But half-billion-dollar companies are *already* big—big enough, certainly, to count themselves among the survivors.

A common explanation has been that Lotus chairman Jim Manzi got tired of having sand kicked in his face by Microsoft chairman Bill Gates. Sadly, this may hold some water. Manzi has certainly been uncomfortable with Microsoft's control over the operating systems under which Lotus products must run. And Microsoft's decision not to support DOS extenders in the pivotal *Windows*, Release 3.0, especially angered Manzi, because it meant that Lotus's flagship *1-2-3* 3.0 wouldn't run under *Windows* 3.0, even as a non-*Windows* standard application.

But at least in theory, all that was papered-over by a bizarre last-minute deal struck among Lotus, Microsoft, and IBM at last fall's Comdex. The three parties held an equally bizarre press conference, at which that decision (and others) were rescinded, and all was pronounced sweetness and light. Of course, just a couple of weeks after that press conference, word went out informally that none of the principals really meant what he said.

If this merger was spurred on the Lotus side by a desire to gain gross sales parity with Microsoft, there is a question about just how much advantage Lotus would gain in that contest by acquiring Novell.

ILLUSTRATION: KAREN STOLPER

Will Lotus/Novell now refuse to write application software to run on DOS and OS/2 machines? Of course not; no matter *NetWare*'s strength, it will never have the established base of those two dominant operating systems.

Will Lotus/Novell now be in a position to dictate to Microsoft? Of course not. Microsoft is unlikely to be very interested in hearing what Novell has to say: after all, Novell is the company that, unhappy with Microsoft's early network hooks in DOS, wrote its own, competitive

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CIRCLE 362 ON READER SERVICE CARD

network operating system—which then embarrassed Gates & Co. by outperforming the Microsoft version.

Ah, but with the advent of *Notes*, perhaps Lotus is getting serious about networked applications. So will there be any product-level synergy between the two companies? Could Novell help push the slow-selling *Notes* out the door any faster?

It's hard to see how.

Notes is going to be a slow burn; Lotus has to get prospects on-board with the *idea* behind *Notes* before it can close the sale. The Lotus sales pitch for *Notes* isn't foundering on LAN problems; it just takes a while for people to understand how powerful *Notes* can be.

Other products? Lotus has people who are perfectly competent to write networked applications now. And Lotus will always have to make certain its network versions run properly on DOS- and OS/2-based (read: *LAN Manager*–based) network operating systems, such as 3Com Corp.'s *3+Open*, as well as on Novell's *NetWare*. While bringing a knowledge of *NetWare* in-house may be interesting, it hardly means Lotus/Novell can ignore the larger networking world.

It's true that Lotus and Novell reps have been calling on many of the same people in Corporate America, which suggests inefficiencies that, once cleaned up, could save the combined companies money.

But the MIS and info center people visited by Lotus and Novell reps see the two groups, and the products they represent, very differently, and are unlikely to be satisfied with joint calls.

DIFFERENT STROKES

Finally, there is the much-discussed Kulchur Klash: the quiet Utah/Mormon Novell people up against the hard-driving Loti from the Bad Ol' East Coast. It isn't necessary to characterize either side's corporate culture with cheap shots to acknowledge that this doesn't look like a fit made in Heaven.

In the end, this deal offers an acquirer driven by the idea that Big is Good and Bigger is Better, and an acquisition driven by instinct to cash out and lock-in asset values.

Hardly bright portents for the surviving company. ■

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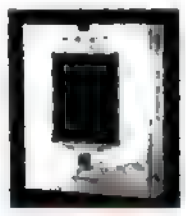

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CIRCLE 112 ON READER SERVICE CARD

William F. Zachmann

The IBMpire Strikes Back

Our mild-mannered columnist believes his plans to take over the computer world are delusionary. Is he really deluded or just inspired?

Warning: The column you are about to read seems to be a bizarre paranoid fantasy. It does not express the views of the normal author of this column or of PC Magazine. *It appears to be the raving of a seriously deranged individual. The scenario it paints—let's call it, The IBMpire Strikes Back—couldn't really happen. Could it?*

Suppose instead of a nice, kind, gentle man like John Akers, some really mean guy, some power-mad evil manipulator—like me, for instance—took over at IBM. What might I do in my most sinister campaign to rule the world—well, the microcomputer world, anyway?

The first thing I'd do to establish my Design of Dominance (DoD) would be to recognize that my predecessors at IBM were a bunch of wishy washy liberals. Instead of ruthlessly acting to stamp out standards (and competition), they tried to balance accommodation with standards, on the one hand, with a far more sensible effort to return to proprietary architectures, on the other.

Fools! Don't they know the inevitability of the fate of one who tries to sit between two stools!? Small wonder, then, that they found themselves falling to the floor and sliding only deeper into the vile morass of standards and of free and open competition! How lucky for IBM stockholders that I got here in time!

Of course, given the weaknesses of my predecessors, I can't simply put my DoD directly into action. I'll have to pretend, superficially, to follow their sorry, insipid ways for a time. But that will only be a cover until I can really get the DoD rolling. Here's how I'll do it.

First of all, I'll start putting lots more distance between OS/2 Standard Edition and Microsoft, on the one hand, and my own IBM proprietary OS/2 Extended Edition, on the other. I've already got plenty of big customers with big IBM mainframes committed to OS/2 Extended Edition, and they'll do pretty much whatever I tell them.

By creating closer proprietary tie-ins with my large and midrange systems, I'll be able to anchor a big portion of large account personal system sales to my proprietary "big iron."

At the same time, I'll keep hinting about how nifty Unix is, without actually making it practical to use in business applications. That way I can pick up a piece of the Unix market for scientific/engineering workstations without cutting into my AS/400 and 3090 sales.

Further, by keeping the Unix versus OS/2 Standard Edition controversy going, I'll muddy the waters for both potential standards, giving me more time to build up my proprietary alternatives. At the same time, I'll do what I can behind the scenes to make sure that the competing Unix versions' sponsors don't get together and agree to a compromise.

Better yet, I'll develop all sorts of exciting-sounding future enhancements for both OS/2 EE and for my equally proprietary AIX version of Unix that will make it seem like anybody who buys into what any other vendor is offering will be missing some great things in the future.

Multimedia might be a real opportunity

ILLUSTRATION: KAREN STOLPER

here. Yes! That's it! I'll start dropping hints to all my customers about these fantastic multimedia technologies I've got up my sleeve. Technologies they just won't be able to live without.

Why, I'll even tell them that without Micro Channel architecture and either IBM proprietary OS/2 Extended Edition or IBM proprietary AIX extensions they probably won't be able to get this mysteriously wonderful multimedia

magic stuff at all! (Heh, heh!)

Then, while all that's going on, I'll get my hardware development people to come up with more new proprietary hardware architectures like the RS/6000. After all, why rely on Intel to charge exorbitant prices for 486s and 586s and the like as a way of messing up my competition, when I can have my own proprietary microprocessor architecture that my competitors can't use at all.

What's more, I'll have my technical types come up with more proprietary twists, like the 40-bit memory chips in the RS/6000, too. Why, we can build all sorts of proprietary I/O controllers, cache controllers, displays, etc.

Of course, I'll make sure that all this stuff makes use of all sorts of newly issued IBM patents that give me absolute control over whether anybody else can build it at all. With sufficient patent protection I can make it impossible for anybody legally to reverse-engineer my iron.

Ah, but how do I get the users who don't automatically do what I tell them to buy all this proprietary stuff? Hmmm. I've got it! I'll simply make it upward-compatible with all that disgustingly standardized stuff they're using now.

Let's see, maybe I'll start by implementing an OS/2 application programming interface (API) on my proprietary microprocessors. Sure. That way I'll be able to entice even reluctant buyers into the proprietary architecture by offering initially aggressive price/performance points and then lure 'em into using proprietary extensions. Once they do that, they can't turn back.

Why, maybe I'll even put an OS/2 API under Unix! That should really confuse 'em. What's more, I could then claim that my proprietary hardware actually offers the only way that they can truly have both "standards" on the same system.

In addition, I'll turn my standing army of intellectual property attorneys loose on my competitors. I'll tie them up in lawsuits and bully them into paying protection money in the form of higher royalties and restrictive agreements.

And I can supplement that by simply buying all or part of those companies that can either be useful to me or that are potentially serious future (or even present) competitors. Heck, I've got enough cash to buy most of the industry!

Just in case some snotty young attorney in the Department of Justice gets uppity, I'll also cover myself legally (or otherwise) with Congress and the Administration. In addition to the usual, uh, support for potential winners in both parties, I'll get public opinion working for me as well.

After all, all I've got to do is convince the rubes that American competitiveness will be severely damaged by not giving me what I want. I can just wrap myself in the flag and make it look like what's good for IBM is what's good for America.

Oops! Looks like I've got to go. The nurse is coming to give me my treatment and that makes me really drowsy. I'm afraid we'll have to end our little chat now. But don't you doubt for a minute that I'm gonna do it, just like I told you.

"Hello, nurse." ■

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The Graphical Advantage:

Tomorrow's Word Processors Today

PHOTOGRAPHY: THOM O'CONNOR

A new age of PC-based word processing is here, and it's a different world. The forerunners of this upstart generation have abandoned the familiar DOS-based character mode in favor of a graphics environment. In doing so, they show admirable foresight—GUIs (graphical user interfaces) and GUI-based software are sure to become more significant, perhaps dominant, in PC technology over the next several years.

Like any pioneers, graphical word processors have obstacles to surmount. They've got to win over the people who have been using character-based word processors for a long time, and who may find GUIs difficult to get used to. In fact, many of these folks have tried various GUI products and have found them to be wanting in speed or computing style; the danger is that they'll succumb to negative thoughts about these

by John Dickinson

new word processors before they even try them.

That would be a mistake because the GUI environment is a powerful one for producing fine-quality, typeset-grade text output. The graphical interface gives you access to the tools necessary for generating that quality. Graphics-based word processors allow you to perform tasks not possible in traditional, character-based programs.

Four of the products reviewed here—*Microsoft Word for Windows*, *Amí*, *Amí Professional*, and *Legend*—run under *Microsoft Windows*. We tested them using *Windows* 2.11; *Windows* 3.0 was unavailable at press time. But there's not one product in that group that won't work better with the new, improved version of Microsoft's DOS-based GUI. The other product we review, *DeScribe*, is the only word processor to use OS/2's Presentation Manager, and we tested it under Release 1.1. (However, don't expect *DeScribe* to be the sole Presentation Manager entrant forever; you can bet that Microsoft will soon come out with an OS/2 version of *Word*.)

GRAPHICAL WORD PROCESSORS: SUITABILITY TO TASK

PC Magazine assesses a word processing program's suitability in five arenas—Personal, Professional, Corporate, Legal, and Desktop Publishing—and assigns a point value for each one. These subjective ratings, on a scale from 0 to 4, are presented along with each review, and translate as follows: 0—lacks feature or is not at all suited; 1—poorly suited; 2—some capability; 3—well suited; 4—ideal for the task.

A **Personal** word processor should be very easy to learn and use; it is best suited for short documents, letters, and memos. Important features include context-sensitive help, simple menus, and clear documentation. Users include students, home users, executives, and other professionals who write short documents.

A **Professional** word processor is more full-featured. It should be able to handle long documents with extensive page formatting, including complex headers, footers, and indexing. Print control and dictionary support are both important, and likely users include professional and technical writers, academics, and those working in the publishing industry.

Corporate word processors should easily handle short documents, letters, and repetitive memos that are produced often, and should offer mail-merge. Document summaries (including author, revisor, keywords) and envelope printing are musts. Parallel versions of the programs that run on IBM and DEC mainframes and minis or Unix systems can also be a plus. Note that not all users within corporations are corporate users.

Legal refers to the program's ability to provide the special functions and formats required by lawyers and law offices, including line numbering, redlining and revision marking, compilation of tables of authorities, file comparison, and password protection.

Word processors with **Desktop Publishing** features must be able to handle multiple columns of text, import common graphics files (.PCX, .CGM, TIFF) as well as *Lotus 1-2-3* and *Excel* spreadsheet data. They should also be capable front ends and partners for the *PageMaker* and *Ventura Publisher* desktop publishing packages.

To receive a rating of 4, the product should provide all features users expect now (based on competitive products) or will find in similar products in the near future (a DTP rating of 4 indicates a word processor with superior DTP features, but not a word processor equal to *PageMaker* or *Ventura Publisher*).

Program Name / SUITABILITY TO TASK				
Personal				4
Professional			3	
Corporate		2		
Legal	1			
Desktop Publishing				

WORD PROCESSING: YESTERDAY, TODAY, TOMORROW...

Early word processors treated the task at hand as one of formatting characters into words, sentences, and paragraphs, and then placing them into predefined locations on a piece of paper. This model depended on fixed or monospaced typefaces like the ones found on typewriters. A text-based word processor that uses the PC's 2,000 on-screen characters to display your output works just fine in this environment. The characters'on-screen locations and sizes are fixed, and even the screen's 80-character line length helps make everything look like the final paper output.

When you introduce proportional typefaces into this mix that a word processor has to consider, the situation gets more complicated. The old model with fixed spacing quickly loses its meaning, and the usefulness of the PC's fixed-size, fixed-position text screen evaporates, because a character's final location on a page no longer falls into neat, evenly divided pigeonholes. Instead, its final position falls wherever the width of the character and its neighbors require it to occur. The only way fixed-spaced on-screen characters can represent widths is to stretch or shrink line lengths, which makes them drop off the edge of the screen, creating a jagged look. That's not much help when you're depending on the screen to show you what your final printed document will look like.

THE PRINTER FACTOR

Today's PC-based word processing reality is even more complex because it includes laser printers, which use proportional typefaces (first introduced to PCs on daisy wheel printers), in addition to multiple type sizes used to create a family of fonts in each of the available typefaces. Some printers, such as the new Hewlett-Packard LaserJet III and PostScript printers, even use scalable typefaces to create an infinite family of fonts for each typeface. I haven't even mentioned a laser printer's ability to position lines of type vertically almost anywhere on a page, or the adroitness with which it can make type darker, kern it, or rotate it by 360 degrees.

Sure, there are character-based word processors on the market that deal successfully with most laser printer typography issues, although *WordPerfect* is the only one that rotates fonts. Products, such as *WordPerfect*, *Microsoft Word*, *XyWrite*, *DisplayWrite*, and even *WordStar*, will cope with a LaserJet-compatible or PostScript language printer just fine. However, your editing screen will show you only the same 2,000 characters you saw

when dealing with fixed-space word processing models—it takes special codes, colors, and prompts to indicate what's really going on with your text. Better products have a page-preview mode that shows you a graphics representation of the finished page, but usually that screen is not editable (the exception here is *XyWrite*), which means you have to go back to the monospaced edit screen to fix any problems you discover.

Graphical word processors use a WYSIWYG editing screen to display a virtually exact representation of your printed text at the same time you are working on your document. If you change the size of the typeface, you'll see the larger font on-screen immediately. You'll also see what happens when you switch typefaces, boldface text, adjust line height and interparagraph spacing, or use an envelope-size page to create laser-printed envelopes. Importantly, you will quickly discover the problems your formatting ideas are creating—for instance, a conflict between line height and font may cause two lines to interfere with each other.

That's just the beginning of the typographic possibilities you receive with this new breed of products. You can insert just about anything from bulletpoints to boilerplates, and you can format it however you like. It's not every day that you need three-column text with intercolumn rulers or headline-size type across two of them, but when you do, all of these GUI-based products will be accommodating. And when it's time to use a color printer to make overhead slides, they will be capable of handling that demand as well.

GRAPHICS, OF COURSE

Then there are graphics. These are, after all, GUI-based products, so if you want to place the company's logo in your text, or even create your own letterhead using that logo, just insert the scanned image where you need it. Better yet, design a new image using any one of a number of good GUI-based drawing products, then cut it out and paste it into your document. The products in this review allow you to

EDITOR'S CHOICE

- **Ami Professional**
- **Microsoft Word for Windows**

Is now the time to switch to a graphical word processor? Yes, but only if you've got fast hardware and if you've seen a feature so compelling that it's worth what will probably be a time-consuming transition. After all, *WordPerfect* and its competitors still have a lot of living left to do in the DOS world. They won't disappear soon.

Only two GUI-based word processors have enough features and convenience to be considered a plausible alternative to character-based programs, and both are so plausible that you may never look back. If you choose either *Ami Professional* or *Microsoft Word for Windows*, you'll choose a program that has functions you won't find anywhere among character-based programs. If you work under *Windows* 2.*x*, you'll sacrifice a lot of speed compared to straight-DOS word processors, but with *Windows* 3.0, the sacrifice is smaller and less painful.

Ami Professional does more to help you construct a document than any other program on the market, and it lets you enjoy yourself in the process. If it only offered its word processing features, it still would be impressive enough to earn the laurels of Editor's Choice, but it also adds extensive drawing and charting functions, convenient tables, and file-management features. *Windows* is designed to let you switch easily from one program to another. With *Ami Professional*, you may not need any other.

Ami Professional has its drawbacks. It doesn't give you full outlining, and the current version hasn't been fully freed from bugs. But the *Windows* 3.0-compatible Version 1.2, due by the time you read this, looks bug-free even in the beta version, and it adds a welcome infusion of speed.

Microsoft Word for Windows isn't as wide as *Ami Professional*, but it goes deeper. Offering virtually all the functions of the DOS version of *Microsoft Word*, it also adds sophisticated, innovative macro features that may eventually transform all PC word processing. Keep in mind, however, that you'll need a fast 386 machine (at least 20 MHz and preferably 33 MHz) to make the program run as fast as it should.

A *Word for Windows* document can be a complex interactive system that guides the user through the process of creating a document and then makes its own decisions on how it should be printed and formatted depending on your choices. If you simply want to write a letter or a report, *Word for Windows* makes the job of formatting simpler and more intuitive than any other program you can find. DDE hotlinks to *Excel* are a spectacular added benefit, showing off the exciting possibilities of graphical environments (*Ami Pro* has them too).

Word for Windows has its deficiencies, but they're small ones. You'll need some expertise in macros and templates before you can customize the program, and some functions, even under *Windows* 3.0, crawl when they should leap. But *Word for Windows* is one of the most successful and ambitious programs ever released for the PC, and there are few users who won't find something in it that they've always wanted to see in the programs they're using now.

edit graphics for size and position, and some let you draw the graphic in place so that you don't have to use another product.

Your word processing document can also be the recipient of charts delivered via warm or cold links from fellow GUI-based applications like *Microsoft Excel*, or from standard DOS products like *Lotus 1-2-3*. *Microsoft Word for Windows*, for example, lets you use a live DDE (dynamic data exchange) link to *Excel*; if you want to amaze your friends, you can create a two-way link between the products so that a value entered into *Word* will be sent to an *Excel* spreadsheet, and the modified chart sent back to *Word*.

DTP SUBSTITUTES?

With such extensive graphics capabilities, you may start to wonder if these GUI-based word processors can take the place of desktop publishing products. In fact, some of these programs even bill themselves as "word publishers" or "document processors." However, while these systems do include DTP-like elements such as adjustable gutter boundaries and intercolumn rulers, they're just not as powerful as real high-end desktop publishers.

Page layout in a typeset-driven world is not quite the same thing as laying out pages for a laser printer. It's really not easy to use these word processors for multiple stories that jump from one page to another. At best, these word processors compete with low-end desktop publishing packages—and they cost a whole lot more.

However, for the extra money, you get extra *word processing* power that you won't find in a low-end DTP package or in your favorite character-based text editor. They move beyond the limitations of their character-based brethren, chiefly because program designers and coders can develop more-flexible and more-powerful programs in a graphics environment. Moving text, for example, is much easier with a graphical word processor, because its mouse-based blocking system is quicker than the cursor-based system designed for character-mode word processing. *Word for Windows* goes a step further with an incredible outliner that takes advantage of the GUI environment to let you easily move text and headings up and down, and promote or demote them, with the mouse or icon buttons.

MACROS AND FORMATTING

Macros have come a long way in these systems. *Amí Pro* and *Word for Windows* include languages that are similar to BASIC, and give you plenty of power to customize your environment and create interactive documents. Document control, especially in *Amí* and *Word*, goes beyond anything found in the DOS world. In addition to normal document background information and search facilities, newer-generation document management includes security locks to prevent a reader from modifying the actual text while allowing the insertion of comments.

Style-based formatting is a powerful tool that's found in virtually all of the products that are reviewed here. This is something that exists in only a few character-based word processors because it must be implemented there with a complex menu system that requires specifying arcane formatting parameters. At best, those implementations are difficult to understand, and at worst they're impossible to use. It's much easier to understand and work with style sheets in a GUI-based word processing program because you can simply teach the product the style you want. Just format your text (and simultaneously see the effects of the formatting), then tell the word processor to save that formatting as a style.

All of these products benefit from the standard pull-down menus, dialog boxes, and buttons. Using them is effective, but often clumsy and slow. The better GUI-based word processors use the graphics environments to create new forms of interacting with you that are more in tune with the task at hand. *Amí*, for example, gives you a "toolkit" that provides instant access to formatting text and menus. *Word* provides special icon bars called the "ribbon and ruler" that let you access its formatting technology.

All the products provide you with a variety of ways to view your document, ranging from faster modes that use draft fonts to full-page preview modes that let you look at multiple pages, and even change their appearance.

THE DRAWBACKS

Not everything in the graphics-based world is perfect, though. GUI-based word processors are great to use, but they're also victims of their own environment and suffer from that in both realism and performance. While they're advertised as having WYSIWYG screens, they really are "what-you-see-is-not-quite-what-you-get," because the screen typography in *Windows* and Presentation Manager is not precise. The font shapes are not accurate, nor are the metrics; that means you'll see line breaks that are not quite correct and typefaces that only reflect the look you'll see on paper.

Perhaps more important is the speed issue. *Windows* is positioned these days as being ripe for any PC, from XTs to 486-based EISA machines. The truth is you won't be satisfied by the performance of your GUI-based word processor on anything less than a 12.5-MHz 286, and then only if you're working on fairly short documents. You can compensate for slower speed by using features like draft mode, and newer editions of these products (like *Amí Pro*, Release 1.16) will be faster.

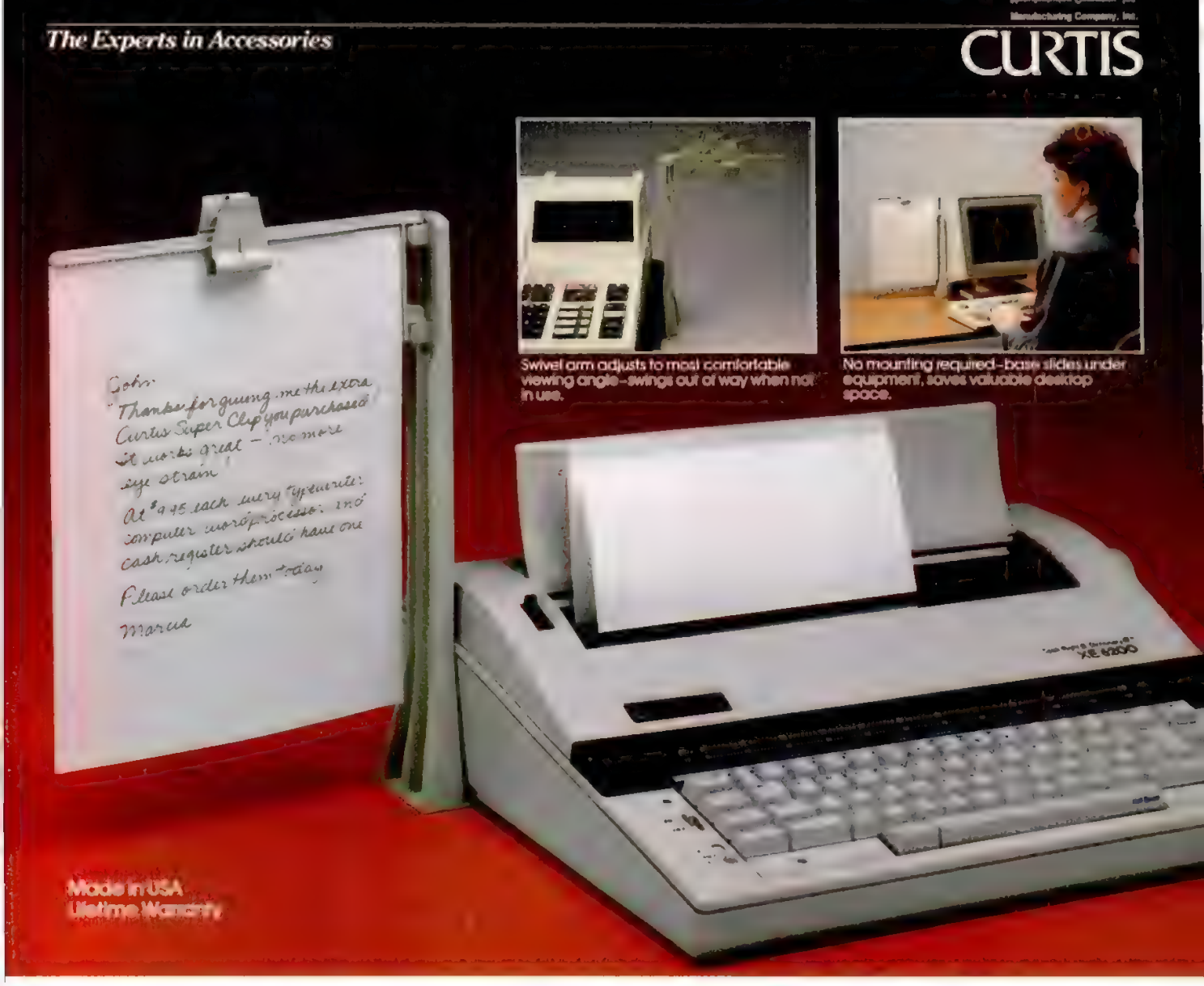
For now, you'll probably want to make the transition to graphics-based word processing only if you've got a fast 286, 386, or 486 machine. If you do, going GUI is the best way to get a lot more out of your word processing, and have a lot more fun doing it.

Amí
Amí Professional

All reviews by Edward Mendelson

Samna Corp.'s $199 *Amí* was the first *Microsoft Windows*-based program that you could use for serious word processing. Its $495 *Amí Professional* is the first *Windows*-based program that you can use for just about anything.

The original *Amí* offers basic word processing functions, including style sheets with such niceties as bullet formats and boilerplate text. It imports graphics, but lacks advanced features like footnoting, sorting, and a thesaurus. *Amí Professional* (or *Amí Pro*), a superset of the original *Amí*, adds virtually every advanced feature you now expect in a word processor, in-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cluding a programmable macro language and simple conditional merges. It also offers some unexpected features, such as four-level undo, image enhancement, charting, and drawing tools. No other document-producing program, short of IBM's gigantic and unwieldy *Interleaf Publisher*, includes such a wide variety of functions.

This review concentrates on *Ami Pro*, Version 1.1B, but the original *Ami*, still available and continually being upgraded, has essentially the same interface as its more-powerful sibling. *Ami Pro* offers more menu choices, and includes the charting and table functions that *Ami* lacks; otherwise the two programs have an identical feel and can effortlessly coexist in the same office environment.

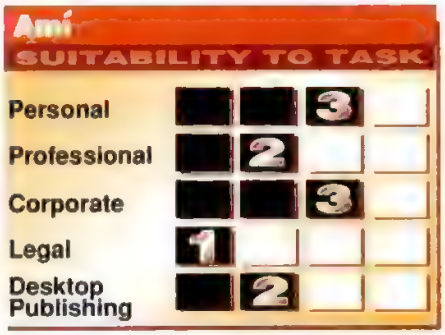
Ami Pro packs its myriad of features into a simple and attractive interface. In fact, you can customize your screen so heavily that another *Ami Pro* user might not recognize it. An optional "sidebar" lets you display up to 12 icons (on a VGA system) for one-click printing, file import, footnoting, or almost 50 other functions. You can display a status line, style menu, drawing toolbox, horizontal and vertical rulers, or even change the field names in the document summary screen. Oddly, you can only change tabs, not margins, using the on-screen ruler.

In WYSIWYG mode, you can view your page in a full range of built-in or customized sizes, or you can switch to a plain-text draft screen that displays character attributes in customizable colors. The draft screen is cluttered with symbols for tabs and carriage returns; however, the clutter can be reduced through customization. In draft mode you won't see breaks between pages, and in WYSIWYG mode you can't see the foot of one page and the top of another on the same screen, except in the unreadable facing-page view. You can speed up searches and spell-checks with a default setting that performs these operations in draft mode.

PROFESSIONAL STYLE

As in *Microsoft Word for Windows*, you can model a paragraph style on text that you have already formatted, modify an existing file, or create a style from scratch. As you select font, point size, leading, paragraph format, bullet formats, boilerplate text, lines, and other features, a box in the menu displays a WYSIWYG sample of the layout. When you're through, return to the editing screen to see the results in your text. This method is less direct than in *Word for Windows*, where you see the result in your text as you alter the format, but it's easier to design styles from scratch and to experiment with a style before applying it to your document.

Ami Professional's styles lack a few of the typographic details possible in *Word for Windows*, and both programs fall short of *WordPerfect*'s ultimate fine-tuning. *Ami Pro* won't let you add a larger font to a line without increasing the line spacing to match (although you can do this in *Ami*). *Ami Pro* only gives you three settings for tracking, and you can't kern individual pairs of characters, although you can use automatic kerning pairs provided by printer drivers. Styles can automatically put lines above and below paragraphs, but you can't have boxes that expand to accommodate inserted text, except in tables. Style names are also case-sensitive, which can be confusing.



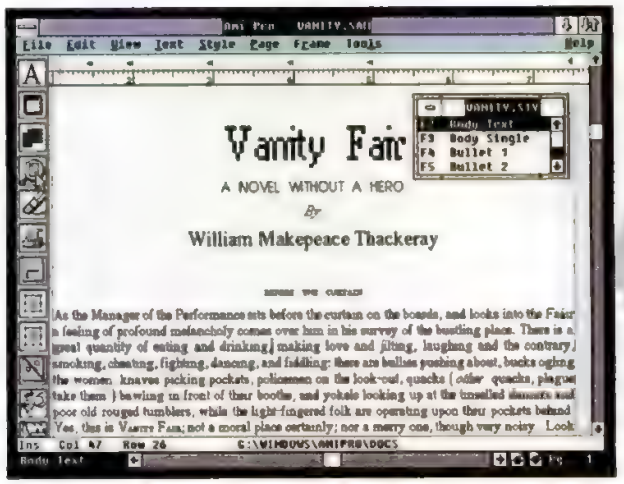
You can record and edit keyboard macros without learning *Ami Pro*'s advanced BASIC-like macro language, but a thick manual is available for free. *Ami*'s macros differ from those in *Word for Windows*; because *Word* has a deeper set of features, it also has a more elaborate language. However, *Ami*'s language includes some functions that *Word*'s language lacks—for example, *Ami*'s macros let you add an entirely new menu to the menu bar. But to most users it matters more that *Word for Windows* lets you adds functions to its existing menus without learning how to write a macro at all.

Ami Pro lets you format text as "protected" so users can't edit it while filling out forms, and you can prevent protected text from printing when using preprinted forms. However, you can't make protected text an element of a style, and it can't be locked as it can be in *Word for Windows*, because you can edit it in draft mode. *Ami Pro* supports bookmarks, which are simply named points in the text, unlike *Word*'s bookmarks that can encompass a range of text that a macro can manipulate.

EASY DRAWING AND CHARTING

While *Ami Pro*'s word processing functions are less deep than *Word*'s, its total range of functions is much broader. Its charting and drawing functions approach those of standalone packages, and are generally easier to use. The object-oriented drawing tools don't allow freehand line drawing, but you can create arcs, polylines, and polygons, in addition to the usual lines, rectangles, and ellipses. You can also enter text into graphics. Choose among preset line and fill patterns, and select foreground and background colors, but forget about customizing lines, patterns, or colors.

Ami Pro lets you enhance imported TIFF files by adjusting contrast and brightness or by smoothing edges using a built-in algorithm. As in the style modification menus, you see a sample of the results as you make the change. No other word processor has anything like it.



Options available on *Ami Professional*'s screen include a customizable icon sidebar, a tab ruler, and a box that lists available styles and function keys assigned to each style. Margins are shown on the tab ruler, but can't be changed there.

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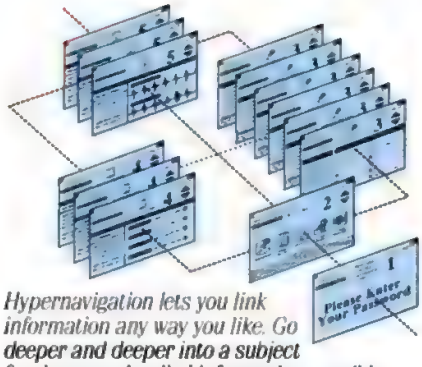

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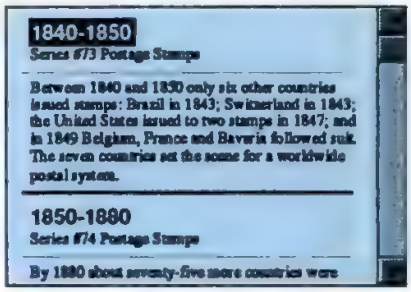

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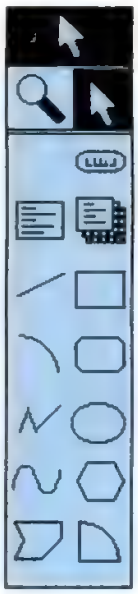

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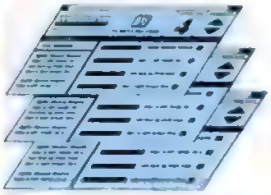

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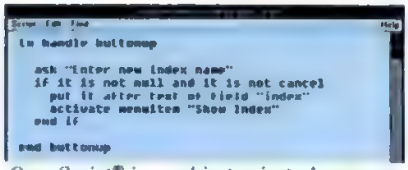

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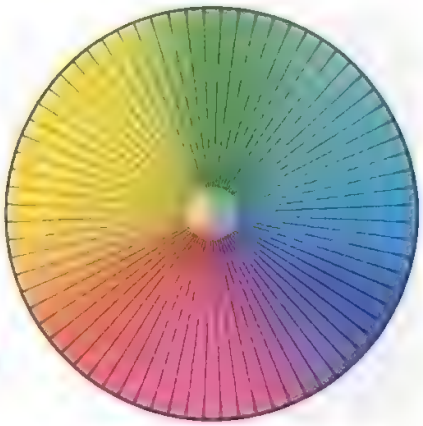

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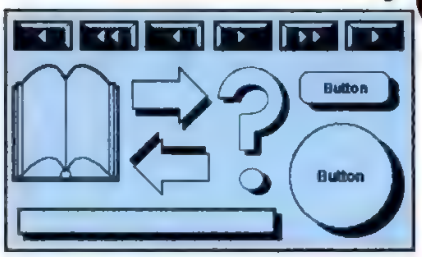

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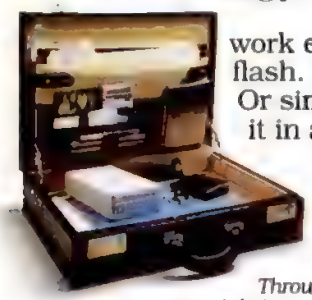

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You can create tables by opening a frame and choosing the number of rows and columns from a menu, or you can let *Amí Pro* do the work automatically by using data imported from the clipboard, via DDE links, or from *Lotus 1-2-3*, *Microsoft Excel*, *dBASE*, *SuperCalc*, or .DIF files. Tables can include four-function math and formulas.

Creating charts is even easier. You can import data in the same way you import it into tables, or you can open a data-entry window where you simply type the numbers you want, adding titles on the top line or in the left column. *Amí Pro* recognizes the titles and automatically draws the chart in any one of 54 styles, most with 3-D or perspective options. Chart legends can be created automatically. DDE links created from the menu are one-way, but a macro can build two-way links in the unlikely event that you'll need them.

The most frequent problem I had when creating charts was *Amí Pro*'s habit of superimposing the legend over part of the chart itself. Fortunately, charts are object-oriented drawings so I could easily manipulate the legend, or any other element, using the drawing tools.

Amí Pro generally imports text as skillfully as it imports data cells or image files. Almost every major word processor format is supported, including somewhat incomplete translations of stylesheet-based formatting in DOS *Word* files. When you bring in an ASCII file, the program asks if the file has carriage returns after each line or each paragraph. If you choose the former, the file is automatically reformatted as an editable paragraph—something accomplished in *Word for Windows* only through a macro. You can also create DDE links between blocked text in a document in another *Windows* application and text in an *Amí Pro* document.

Of all GUI word processors *Amí Professional* is perhaps the most enjoyable to use.

Among the program's other conveniences are timed backup and optional noncollated printing that lets you produce multiple copies of a file at a far greater speed than normal collated printing. You can also print pages in reverse order.

Although you can't open multiple windows, the file menu lets you open another copy of the program with a second document. With *Windows* 2.*x*, you can normally open two copies of *Amí* at the same time; *Windows* 3.0 will allow many more.

On the PC Labs benchmark tests *Amí Pro* generally performed a respectable second to *Word for Windows*, although it was slightly faster in a couple of tests. The original *Amí* produced similar results, although it was slower in scrolling through the full test file. While *Amí Pro* is satisfyingly fast in text entry and editing (WYSIWYG modes are no exception), it can be stupefyingly slow in drawing a page preview on the screen—even on a 33-MHz machine with a speedy VGA card. You can speed scrolling by turning off the display of bitmap images, but you can't escape the slowdown caused by displaying drawings and charts, except in draft mode.

I encountered a few annoying bugs that involved tables and graphics. Parts of the chart legends sometimes appeared in the wrong font. When I zoomed on an image consisting of a few arcs, the program displayed a "Divide by Zero" error message and kicked me back to *Windows* without saving my work. When manipulating some cells in a table overlapped by a chart, an error message told me an internal error had occurred and suggested that I save my work under another name and exit. But I couldn't escape the error message and had to reboot.

I tried out a beta copy of *Amí Pro*, Version 1.2, due for release by the time you read this. It eliminates all the bugs I found in this version, is fully compatible with *Windows* 3.0, runs at somewhat better speed, lets you anchor frames to neighboring text, and adds a much fuller suite of keystrokes for defining and manipulating text. *Amí Pro* has always been able to export files in *Amí*'s format; an upcoming version of *Amí* will directly read and display *Amí Pro* files, although it won't let you edit tables and drawings created by that program.

Of all GUI word processors, *Amí Professional* has the widest variety of features and is perhaps the most enjoyable to use. Few programs in the DOS world combine power and pleasure in such a productive manner.

Amí Professional
SUITABILITY TO TASK

Personal	3
Professional	4
Corporate	3
Legal	2
Desktop Publishing	4

FACT FILE
EDITOR'S CHOICE

***Amí*, Version 1.0B;**
▶ *Amí Professional*, Version 1.1B
Samna Corp., 5600 Glenridge Dr., #300, Atlanta, GA 30342; (800) 831-9679, (404) 851-0007.
List Price: *Amí*, $199; *Amí Professional*, $495.
Requires: 640K RAM, hard disk, 80286 processor, *Microsoft Windows*-supported graphics adapter, DOS 3.0 or later; mouse recommended. Both programs ship with a runtime version of *Windows*, but the full version of *Windows* is recommended.
In Short: More than a full-featured word processor, *Amí Professional* includes charting and drawing functions that let you dispense with separate packages. This remarkably rich program is surprisingly simple and intuitive. The less-powerful *Amí* provides many of the word processing functions found in *Amí Pro* and looks almost identical. You don't get drawing, charting, or tables, but you can create documents with complex formats easily.

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DeScribe

DeScribe, the only word processor available for OS/2 Presentation Manager, is a lot like OS/2 itself. DeScribe's $595 "word publisher" represents a radical rethinking of its product category. And just like OS/2, *DeScribe* is not quite ready to be launched on the public, although it will be a splendid product when it is finished.

It already boasts one spectacular feature that you'll never see in DOS—an unlimited undo function. Like a time machine, it lets you move backward through an entire editing session and bring a block of text you discarded an hour ago into your current version, or even return to the version you prepared two hours ago and start over from there.

In its basic structure, *DeScribe* resem-

GRAPHICAL WORD PROCESSORS: SUMMARY OF FEATURES

Products listed in ascending price order

	Ami $195	Ami Professional $495	Legend $495	Microsoft Word for Windows $495	DeScribe $595
Operating system	*Microsoft Windows 286 or 386*	*Microsoft Windows 286 or 386*	*Microsoft Windows 286 or 386*	*Microsoft Windows,* Version 2.11	OS/2 Presentation Manager
TEXT FORMATTING FEATURES					
Continuous underline	■	■	■	■	■
Broken underline	❑	■	❑	■	❑
Double underline	❑	■	■	■	❑
Superscripts/subscripts	■	■	■	■	❑
Italics	■	■	■	■	■
Overstrike	❑	■	■	❑	■
Strikethrough	❑	■	■	■	■
Small capitals	❑	■	❑	■	❑
Adjustable top and bottom margins	■	■	■	■	■
Variable page length within document	❑	■	■	❑	■
Vertical centering	❑	■	❑	■	❑
Hard page breaks	■	■	■	■	■
Tabs can be entered anywhere	■	■	■	■	■
Tabs move when left margin changes	■	■	■	■	■
Paragraphs can be linked together on one page	■	■	■	■	❑
Unbreakable blocks	■	■	■	■	❑
Widow/orphan control	■	■	■	■	❑
Automatic page numbering	■	■	■	■	■
Automatic resetting of page numbers	■	■	■	■	■
Creates headers	■	■	■	■	■
Creates footers	■	■	■	■	■
Variable line spacing within document	■	■	■	■	■
Spacing adjusts to font height	■	■	■	■	■
Leading available	■	■	■	■	■
COMMAND STRATEGY					
Command line	❑	❑	❑	❑	❑
Partial-screen menus	■	■	■	■	■
Menus can be bypassed from keyboard	■	■	■	■	■
Permanent defaults can be changed	■	■	■	■	■
Temporary defaults can be set	❑	❑	❑	■	■
SCREEN DISPLAYS					
Screen displays ruler line	■	■	■	■	■
Ruler line can be suppressed	■	■	■	■	■
Margin positions are graphically displayed	■	■	■	■	■
Ruler/status line shows character columns	■	■	❑	■	■
Ruler/status line shows line number	■	■	❑	■	■
Ruler/status line shows page number	■	■	■	■	■
Ruler/status line shows filename	■	■	■	■	■
Page breaks are shown while typing	■	■	■	■	■
Format codes can be displayed	❑	■	■	■	■
On-screen underline	■	■	■	■	■
On-screen bold	■	■	■	■	■
TEXT ENTRY AND EDITING					
Undelete capability	■	■	■	■	■
Multiple undelete levels	None	4	1	None	Unlimited
Mouse-controllable cursor	■	■	■	■	■
Word block	■	■	■	■	■
Line block	■	■	❑	■	■
Sentence block	❑	❑	■	■	■

❑—Editor's Choice ■—Yes ❑—No

CONTINUES

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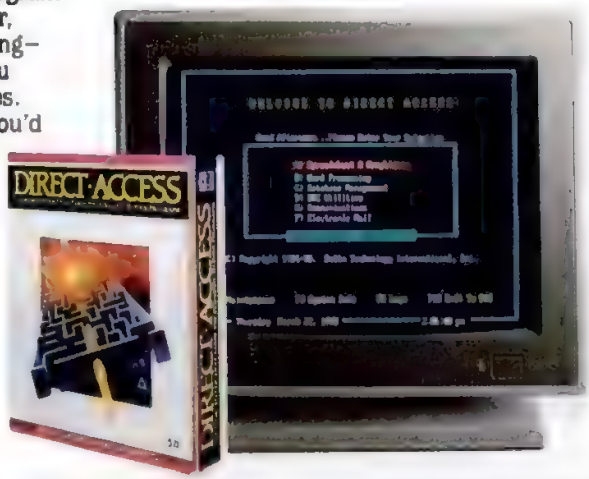

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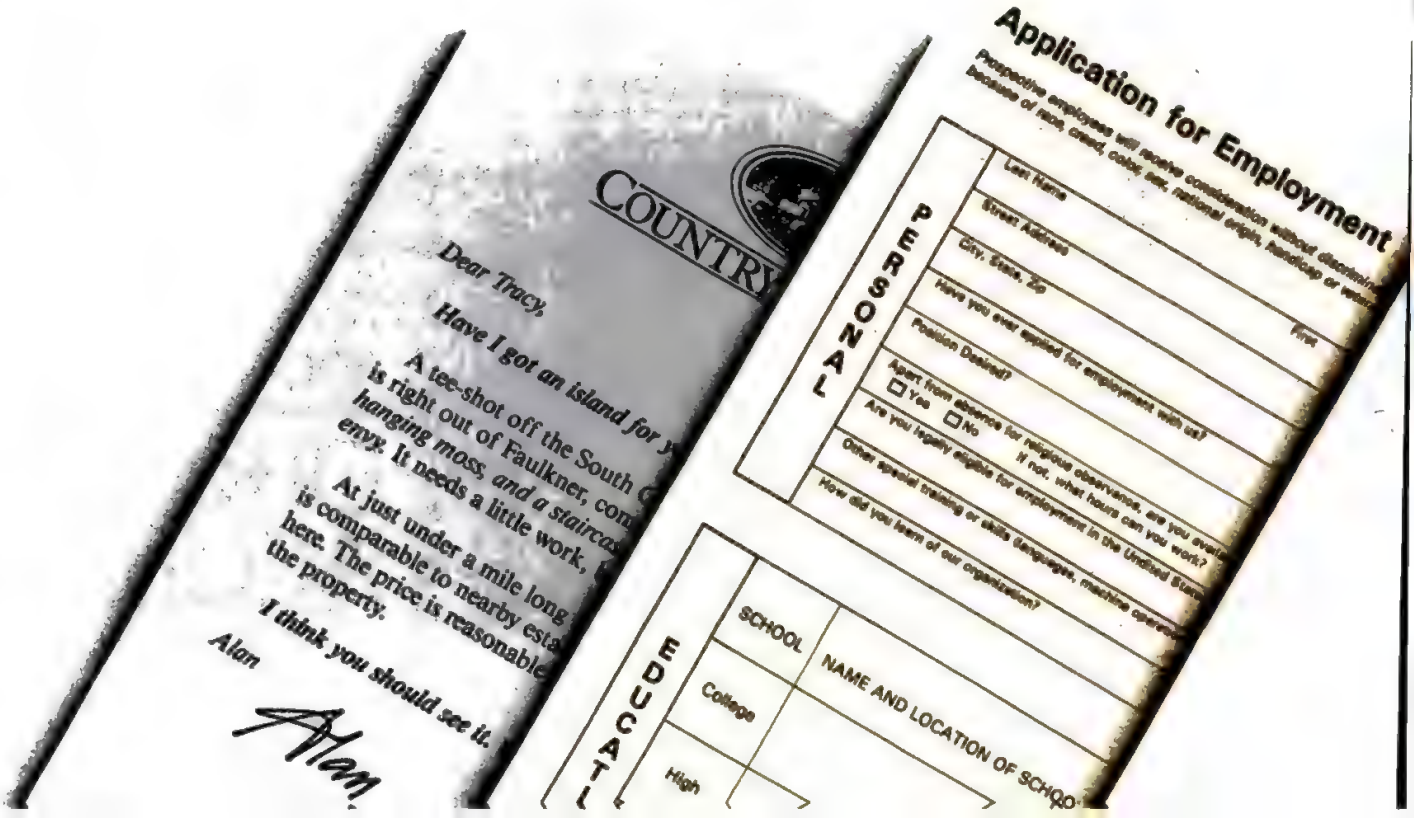

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PC MAGAZINE
EDITORS' CHOICE
June 12, 1990
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CIRCLE 235 ON READER SERVICE CARD

GRAPHICAL WORD PROCESSORS: SUMMARY OF FEATURES

	Ami	Ami Professional	Legend	Microsoft Word for Windows	DeScribe
Paragraph block	❑	❑	■	■	■
Page block	■	❑	■	❑	■
Block can be extended	■	■	■	■	■
Reformats automatically after block move	■	■	■	■	■
Copies or moves to another window	■	■	■	■	■
Saves reformat parameters to a file	■	■	❑	■	■
Appends block to an existing file	❑	❑	❑	■	■
Search-and-replace:					
Works forward and backward	■	■	■	■	■
Verifies replace	■	■	■	■	■
Searches within other files	❑	❑	❑	■	❑
Performs case-sensitive search	■	■	■	■	■
Preserves case when replacing	■	■	■	■	■
Uses wildcards	❑	■	■	■	■
Search-and-replace for format codes	■	■	■	■	■
Search-and-replace for text attribute (underline, italics, bold)	■	■	■	■	❑
Text windows:	■	■	❑	■	■
Number of windows	9	9	N/A	8	28
Split-screen windows	■	■	N/A	■	■
Full-screen windows	■	■	N/A	■	■
PRINTING					
PostScript printer support	■	■	■	■	■
Background printing	■	■	■	■	■
Queues documents for printing	■	■	■	■	■
Handles multiple printers	■	■	■	■	■
Changeable print queue	❑	❑	❑	❑	■
Prints block	❑	❑	❑	■	❑
Prints continuous range of pages	■	■	■	■	■
Prints discontinuous range of pages	❑	❑	■	❑	❑
Prints high-order ASCII characters	■	■	■	■	■
Supports characters not in IBM character set	■	■	■	■	■
Automatic envelope formatting and printing	❑	❑	❑	■	■
Landscape printing	■	■	■	■	■
FILE HANDLING					
Creates .BAK file	■	■	■	■	■
Makes backups during save and resume	■	■	■	■	■
Performs backup at time intervals	■	■	❑	■	■
Includes file-management functions	■	■	❑	■	❑
Searches disk for a filename	❑	❑	■	■	❑
File import/export:					
DCA	■	■	■	■/❑	❑
Lotus 1-2-3	❑	■/❑	■/❑	■	❑
Microsoft Word	■	■	■/❑	■	❑
MultiMate	■	■	■/❑	■	❑
WordPerfect	■	■	■/❑	■	❑
WordStar	■	■	■	■	❑
DDE support	❑	■	❑	■	❑
SPELL-CHECKER, HYPHENATION, THESAURUS					
Spell-checker:					
Number of words in dictionary	130,000	130,000	80,000	130,000	80,000
Maximum number of user dictionaries	1	1	1	3	23

PC—Editor's Choice ■—Yes ❑—No
N/A—Not applicable: the product does not have this feature.

CONTINUES

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CIRCLE 395 ON READER SERVICE CARD

GRAPHICAL WORD PROCESSORS: SUMMARY OF FEATURES

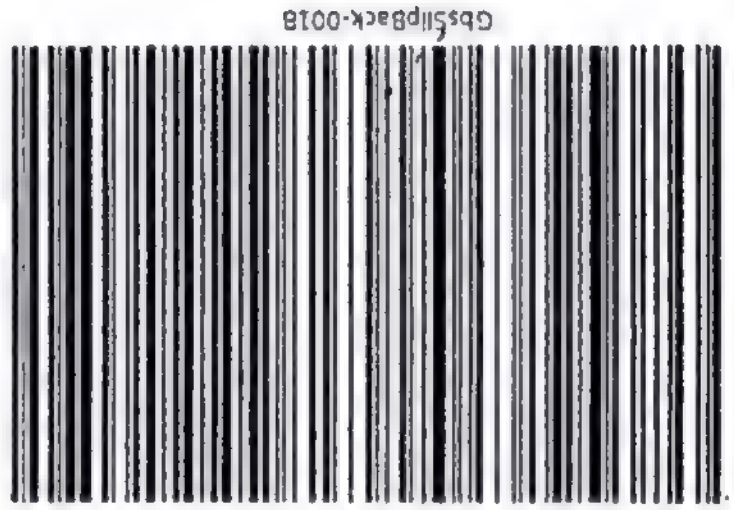
	Ami	Ami Professional	Legend	Microsoft Word for Windows	DeScribe
Spell-checks single word	■	■	■	■	■
Spell-checks defined block	■	■	■	■	■
Legal spelling checker	❑	❑	■	■	■
Medical spelling checker	❑	❑	■	■	■
Hyphenation:					
Based on algorithm or dictionary	Algorithm only	Algorithm only	Algorithm only	Algorithm only	Both
Inserts soft hyphens	■	■	■	■	❑
Enters soft hyphens from keyboard	■	■	■	■	❑
Readjusts to additions and deletions	■	■	■	■	■
Thesaurus	❑	■	❑	■	■
Antonyms provided	N/A	❑	N/A	❑	■
MANUSCRIPT PREPARATION					
Table of contents	❑	■	■	■	❑
Multilevel formats	❑	■	■	■	❑
Footnotes and endnotes	❑	■	■	■	❑
Different fonts	❑	■	■	■	❑
Automatic numbering	❑	■	■	■	❑
Indexing	❑	■	■	■	❑
Multilevel indexing	❑	■	■	■	❑
Cross-referencing	❑	❑	■	■	❑
DESKTOP PUBLISHING FEATURES					
Snaking columns:					
Single and snaking columns on same page	■	■	■	■	■
Maximum number of columns	8	8	32	11	20
Full justification and microjustification	■	■	■	■	■
Side-by-side columns	❑	■	■	■	■
Maximum number of columns	N/A	Unlimited	32	32	20
Full justification and microjustification	■	■	■	■	■
Unmatched column widths available	■	■	■	■	■
Adjustable gutter widths	■	■	■	■	■
Restore single column automatically	■	■	■	■	■
Define column widths by moving cursor	■	■	❑	■	❑
Line drawing using cursor	❑	■	■	❑	❑
Line drawing using menu	■	■	■	■	❑
Expandable box around text	❑	■	■	■	■
Graphics files imported	.PCX, .PIC, .TIF	.EPS, .PCX, .PIC, .TIF	.CGM, .DRW, .PCX, .PIC, .PLT, *MacPaint*, .MSP, .TIF	*AutoCAD*, .CGM, HPGL, *Lotus 1-2-3*, *Micrografx*, Mirage IMA, NAPLPS, .PIC, .TIF	Bitmaps, metafiles
Resizes imported graphics	■	■	■	■	■
Text flowing around graphics	■	■	■	■	■
Page preview	■	■	■	■	■
Full-page portrait monitor supported	■	■	■	■	■
Zoom image	■	■	■	❑	❑
Exports directly to *PageMaker*	❑	❑	❑	❑	■
Exports directly to *Ventura Publisher*	■	■	❑	❑	❑
NUMERIC FEATURES					
Arithmetic operations within document	❑	■	❑	■	❑
PROFESSIONAL FEATURES					
Mail-merge	❑	■	■	■	■

—Editor's Choice ■—Yes ❑—No
N/A—Not applicable: the product does not have this feature.

CONTINUES

PC SALOON

NICE TO KNOW WHEN



Back

1. Follow instructions on the other side

Inverted Back

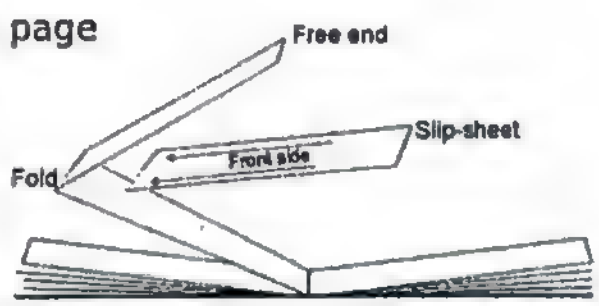
1. Follow instructions on the other side

Folded edge of the page

gbsSlipSheet-001

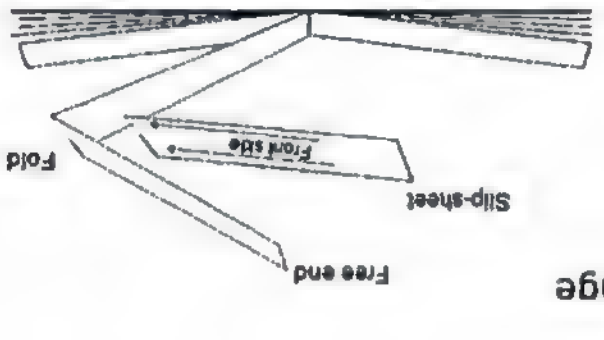
Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
    1. Front side touching the free page
    2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



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33M

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GUARANTEE

GRAPHICAL WORD PROCESSORS: SUMMARY OF FEATURES

	Ami	Ami Professional	Legend	Microsoft Word for Windows	DeScribe
Group editing and file comparison					
Revision marking	❑	❑	❑	■	❑
Changes verified one by one	❑	❑	❑	■	❑
File comparison	❑	❑	❑	■	❑
Outline numbering	❑	■	■	■	❑
Collapsible outlines	❑	❑	❑	■	❑
HELP, DOCUMENTATION, AND ERROR HANDLING					
Context-sensitive on-line help	■	■	❑	■	■
Adjustable help levels	❑	❑	❑	❑	■
Tutorial	■	■	■	■	■
Indexed reference manual	■	■	■	■	■
Error messages explain errors	■	■	■	■	■
Error messages explain remedy	■	■	■	■	■
TECHNICAL SUPPORT					
Free support	■	■	■	■	■
Toll-free telephone number	❑	❑	■	❑	■

—Editor's Choice ■—Yes ❑—No

ENDS

bles *Windows*-based word processing and desktop publishing programs. You use styles to format text and "objects" (or frames) to locate text and graphics on the page. Once you move beyond the basics, however, *DeScribe* looks different and is potentially more powerful than its cousins on the *Windows* side of the GUI family. Because it runs under OS/2, *DeScribe* can open as many as 18 files—the operating system refuses to open any more. In DOS-based programs, all the styles available for a document appear on the style menu, even though many are suitable only for sections like title pages or indexes. In *DeScribe*, you can clear the clutter by organizing stylesheets on a hierarchical structure resembling a directory tree.

For example, the "root" stylesheet might contain the styles for the main body text of a book. A subdirectory of styles for chapters starts with the characteristics of the root directory, but can contain new styles exclusive to itself. This means that when you work on an ordinary chapter of a book, only the styles for chapters are displayed on a menu; when you work on the title page, a different set of styles is displayed. While its style menu can be confusing because the "path" of a stylesheet looks like the path of a directory, it makes complex documents easier to manage. Another possible source of confusion is *DeScribe*'s refusal to put a check next to the style that applies to the current cursor position. You can only find its name on a status line at the foot of the screen.

In *DeScribe*, Version 1.0, the objects aren't any better than the frames found in DOS or *Windows*-based programs. In one way, they're more annoying because you have to give a name to every object you create. You don't need to create an object if you simply want to enter ordinary text, but you do need objects if you want to divide your page into separate elements. If text overflows an object on the page, the object can be automatically repeated on alternate pages if you want a different layout on the left and right pages. However, there's no way to flow text from an object on the second page to an object on the fifth page, or between different-sized objects on different pages.

FACT FILE

DeScribe, Version 1.1
DeScribe Inc., 4047 N. Freeway Blvd., Sacramento, CA 95834; (916) 646-1111.
List Price: $595.
Requires: 3MB RAM, 80286 processor or higher, 20MB hard disk (40MB recommended), Presentation Manager-supported graphics adapter (VGA recommended), OS/2 1.1 or later; mouse also recommended.
In Short: The first Presentation Manager word processor lacks some crucial features and suffers from a clumsy menu structure, but has the best undo feature in the industry. Version 1.1, due this spring, is the program that Version 1.0 should have been; it includes extensive formatting and slightly better organization.

CIRCLE 397 ON READER SERVICE CARD

POWERFUL BUT UNCOMPROMISING

DeScribe's formatting is as powerful and flexible as any other product on the market, although you sometimes have to go through contortions to apply it. Defining a style is straightforward enough; as in *Ami Professional*, you set font and point size from a large menu, and choose optional submenus for text attributes, alignment, hyphenation defaults, and other features. Applying direct formatting to a block of text is a different story: you must repeatedly reopen a small format menu and then choose a separate submenu for font, point size, and some, but not all, of the features available on the main style menu. The point-size submenu lists only a few sizes, and from there you can't enter a size that's not represented. If you do want a size that isn't there, including something as common as 11-point, reopen the format menu and choose the Other submenu.

DeScribe gives you full control over word spacing and letter spacing, and even lets you adjust the ratio of spaces between words and letters. You can format a character in a header or footer as a page number, and *DeScribe* will automatically in-

crement the number on subsequent pages. You can also choose a language as part of the definition of a paragraph style, and *DeScribe* will switch from an English-language dictionary to optional foreign or technical dictionaries when spell-checking that text. Among DOS programs, only *WordPerfect* has a similar feature.

As far as word processors go, *DeScribe* is the most uncompromising in its WYSIWYG abilities. In Version 1.0 you can enter and edit text only on a full-scale representation of the printed page, and you can't switch to an unformatted draft mode for better speed. You can see the bottom of one page and the top of the next at the same time, but you can't tell *DeScribe* to hide the top and bottom page margins if you prefer to use your screen for text instead of white space. As in *Microsoft Word* you can open separate windows on the same file, and edit different sections in each window. In Version 1.1, which should be out by the time you read this, you can zoom in for a close-up look at small details, and split the screen to edit on a full-scale image in one window while simultaneously observing the changes in another window containing reduced thumbnail image of one or more pages.

Although you can only view your work at one scale, Version 1.0 gives you many ways of seeing it. You can choose a clean display or one that shows format codes like tabs and carriage returns, various status indicators, a ruler, or any combination of these. You can replace images with empty boxes to improve scrolling speed, and *DeScribe* is even considerate enough to let you stop the cursor from blinking.

As in *Ami Professional* and *Microsoft Word for Windows*, you can add macros to menus. A simple mail-merge system is actually a macro added to the menu on installation. According to your tastes *DeScribe* even lets you attach a custom help file to a macro when you assign it to a menu, and it lets you easily reorganize everything in its entire menu system.

VAULTING AMBITION

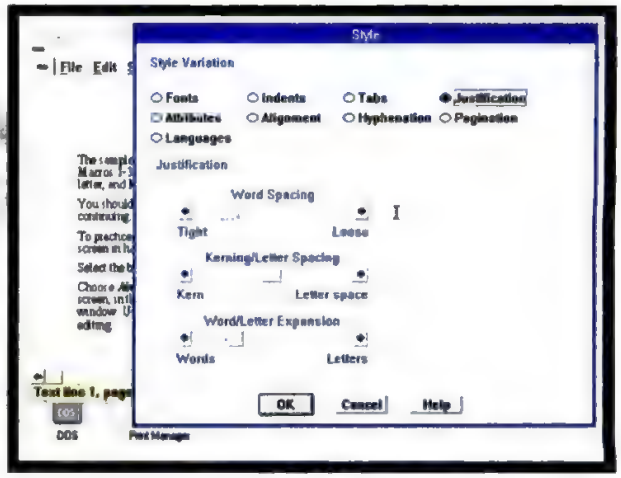
DeScribe is extraordinarily ambitious in some areas, surprisingly timid in others. Both its speller and thesaurus include definitions, and the speller can flag punctuation errors, in addition to conducting two simultaneous search and replace operations. After you record a macro, or write one using the advanced macro language, you can compress it for greater speed with the program's built-in macro compiler. If

DeScribe
SUITABILITY TO TASK

Personal	
Professional	2
Corporate	1
Legal	1
Desktop Publishing	2

you use *DeScribe* as a program editor, you can link it to a separate compiler, and move interactively between it and the compiler when the latter reports errors. The program also takes periodic "snapshots" of your work so that after a system crash, it can automatically restore you almost to the point where you left off.

For all its features, however, Version 1.0 is essentially a rough sketch of what a GUI word processor should be. It lacks indexing, footnoting, lists, and tables of contents. It doesn't let you jump to a specific page—you have to scroll through the file until you find the one you want. It doesn't support superscripts or subscripts, but makes you define them manually via a macro. It displays a ruler at the top of the screen, but doesn't let you do anything with it. You can only import ASCII text files or, by way of the clipboard, Presentation Manager graphics metafiles. The manual is merely a tour through the menus instead of a real guide for getting anything done. Additionally, on PC Labs' benchmark tests, *DeScribe* produced often disappointing results—generally slower than *Word for Windows* running under the heavy burden of *Windows* 2.11.



***DeScribe* gives you exceptional typographic control over spacing between letters and between words, and even the ratio of space between letters to space between words. You can alter spacing using these slider bars, or you can enter an exact figure.**

To install Version 1.0, you run a primitive batch file that won't let you use any drive higher than F:. Once you get the program installed, consider yourself lucky if you manage to print with anything other than a PostScript device. You can't really blame *DeScribe* for printer problems, since you have to be lucky to be able to print at all under OS/2. However, DeScribe Inc. can be criticized for the fact that technical support is free only for 90 days. After that, single users pay $95 per year, corporations $1,100. Optionally, you can use a credit card to buy 3 minutes of support for ten dollars and one dollar per minute thereafter. All this for a program that's pricey to begin with?

HOPE FOR THE FUTURE

Most of *DeScribe*'s limitations are eliminated in Version 1.1, which I tested in the form of a late beta copy. Actually, this is the version that should have appeared in the first place. It includes extensive graphics and word processing import filters, and adds an impressive set of drawing tools. It also supports borders, drop capitals, superscripts and subscripts, tables of contents, indexes, and lists. The ruler at the top of the screen finally lets you adjust tabs, and you can protect text against revision and unprotect it with a password.

Even *DeScribe* 1.1 doesn't have all the pieces in place, though. It still lacks footnoting and the format menu, and although it includes options that make it easier to use, it doesn't make it easy enough. But if you need a word processor for Presentation Manager, *DeScribe* 1.1 isn't merely the only choice—it's a choice you can live with until a future version fulfills the program's promise . . . or until a full-featured rival arrives.

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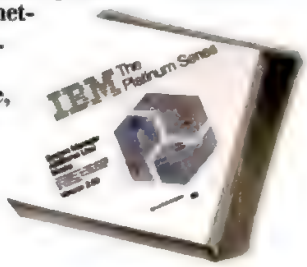
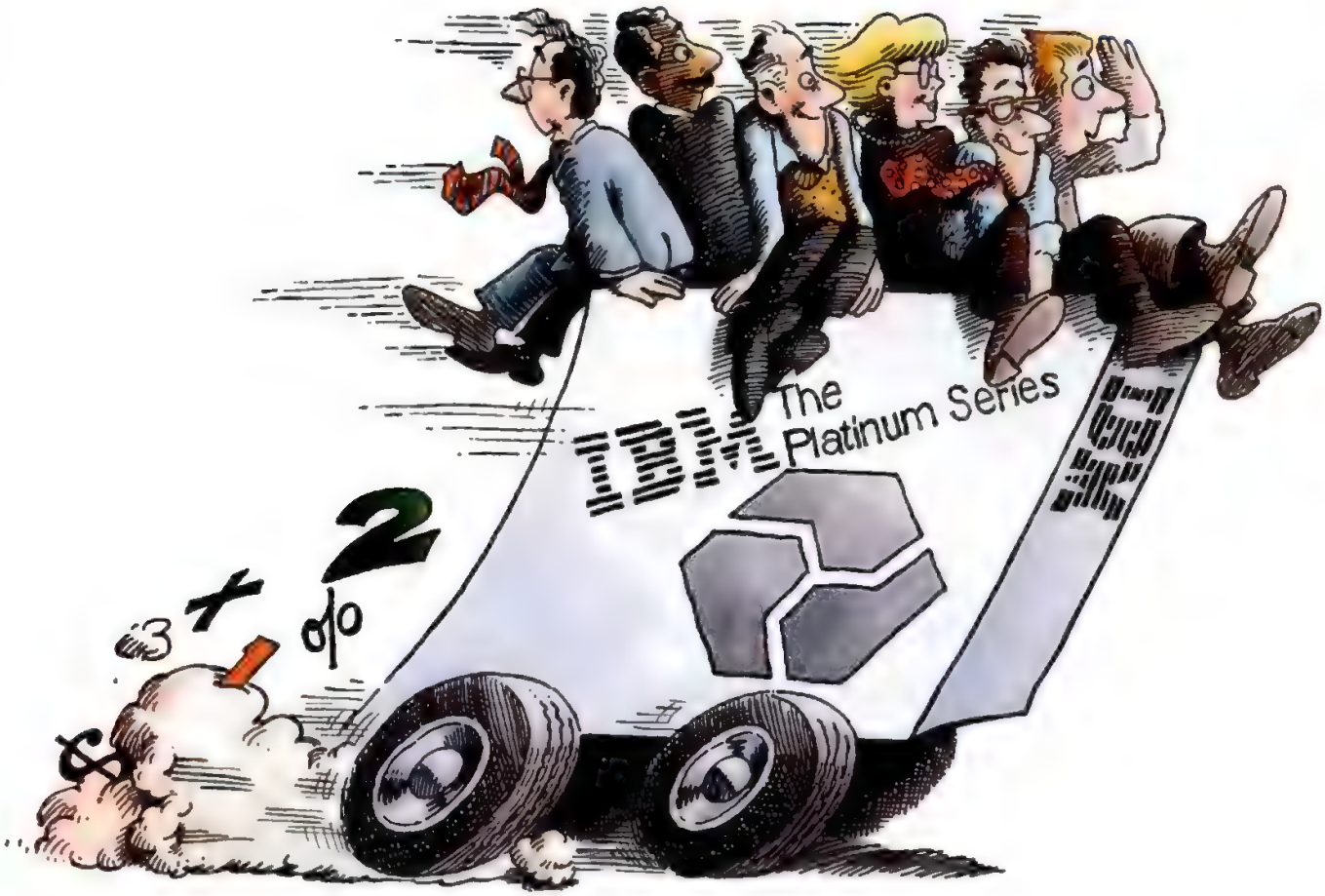


IBM



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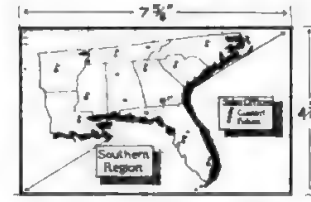

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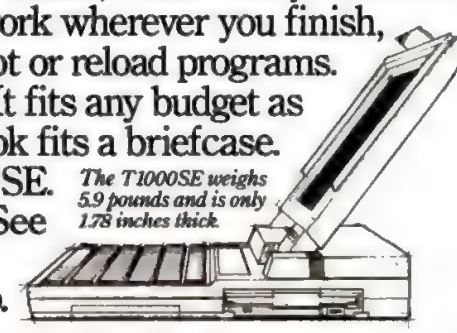

The T1000SE weighs 5.9 pounds and is only 1.78 inches thick.

The Toshiba T1000SE: Battery-operated 80C86/9.5MHz, 1.44MB 3½ diskette drive, 1MB RAM expandable to 3MB, backlit LCD, removable rechargeable battery pack, AutoResume, dual-function port for parallel printer or external 5½" FDD, RS-232C serial port, dedicated modem slot. For more information call 1-800-457-7777.

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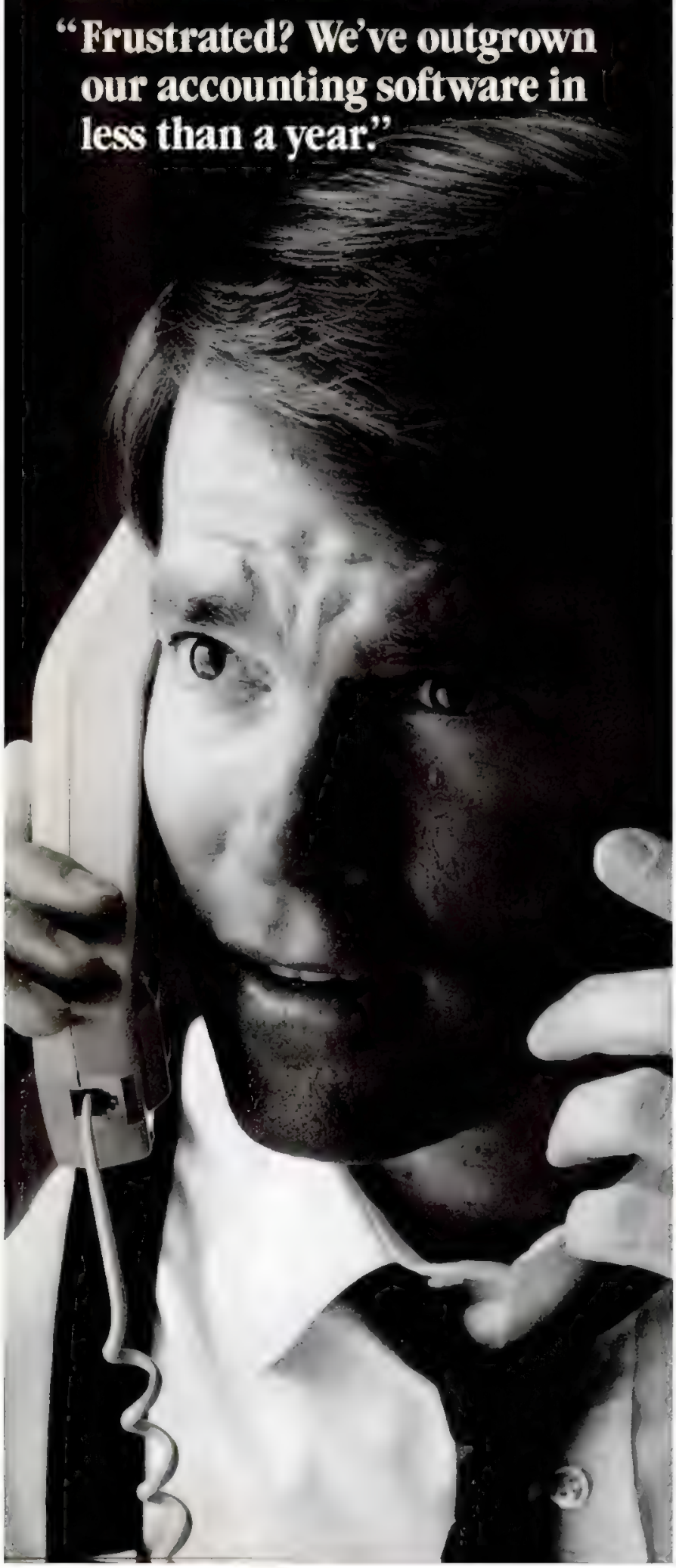
Toshiba America Information Systems Inc., Computer Systems Division



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Legend

NBI considers its $495 *Legend* a tool for "document processing." That means this *Microsoft Windows*-based package can't decide whether it's a graphical word processor or desktop publishing software, although it boasts features that the best programs in each category might envy. If you need to locate text and graphics on a page with microscopic precision, or if you require advanced tools for typographic control, *Legend* may be the program to choose. But don't expect speed, convenience, or reliability.

As a word processor, *Legend* provides most of the features found in advanced character-based programs plus some valuable extras. It includes spell-checking, hyphenation, single-level undo, and mail-merge. You can create lists, tables of contents, outlines, footnotes, cross references, and elaborate multilevel indexes complete with "See also" entries. *Legend* also automatically formats tables for imported .DIF, .WKS, and .WK1 files. Most other programs let you use wildcard characters in a search; *Legend* is unique in letting you use them in the replace string as well.

Unfortunately, *Legend* lacks or underimplements several standard functions. You can't use macros, edit more than one document, or collapse outlines. When you use the search/replace menu, *Legend* often doesn't move the text you've located; you have to move the menu with the mouse until you find the cursor again. Similarly, the speller menu often hides the context of the words it flags. If you want endnotes, you have to perform a nightmarishly complex procedure that takes technical support 20 minutes to explain. At least the call is toll-free.

ITS SHINING MOMENTS

Legend does shine when it comes to typographic control—the middle ground where word processing starts to become desktop publishing. You format text (including hidden text) using paragraph styles, although you can add emphasis or change the fonts of a defined block within a paragraph. You can use separate kerning and word spacing settings throughout a document, in text governed by individual styles, or in any defined block. You can use (but not customize) letter spacing.

Legend's editing screen is sparse, without icons or other distractions. You can prevent the small "style" markers from displaying at the start of each paragraph. The large letters at the start of the first paragraph were created using the built-in drop-cap option.

There are built-in, fully customizable drop caps and bullets. You can also customize subscripts and superscripts, and even specify the width and length of footnote separators. PostScript fonts can print at sizes from one to 792 points. Styles can be set so that text straddles columns or prints automatically at the top of a new column. One small limitation is *Legend*'s refusal to let you use a larger font for one word on a line without increasing leading to match.

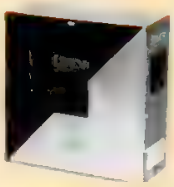
You can assign styles to function keys, but other aspects of style management are less convenient. You can't create styles on the basis of directly formatted text, but must modify an existing style. You can import styles only from other documents, not from stylesheets; this means you'll need to create documents solely as style templates and hope you'll be able to tell them apart from normal documents on the file menu. As in *Ami Professional*, style names are case-sensitive, which may be a potential source of confusion.

As a DTP package, *Legend* offers few frills beyond those found in the best low-end programs, but it lets you divide a page or document into frames, and then flow text between frames—something you can't do with other GUI word processors. You can even tell the speller to scan only the text in a "storyline" consisting of linked frames.

Legend lets you specify the location of a frame to the nearest $^{1}/_{1,000}$ inch. You can also draw straight lines with any thickness, and ellipses or boxes (which don't expand when text flows into them) with any of 32 fill patterns. Text and graphics' colors can be customized, and you can create dictionary-style page headers more easily in *Legend* than in *Word for Windows;* otherwise it doesn't even approach *Word*'s depth of features.

A set of optional vertical and horizontal rulers can be dragged across the screen to let you measure the exact position of any element on the page. A status window supplies the numerical measurements of frames, and you can make frames snap to margins, other frames, or to a customizable invisible grid across the page. Column

FACT FILE



***Legend*, Version 2.01**
NBI Inc., 3450 Mitchell Lane, Boulder, CO 80301; (303) 444-5710.
List Price: $495
Requires: 640K RAM, hard disk, *Windows*-supported graphics card and mouse. DOS 3.2 or later. Shipped with a runtime version of *Microsoft Windows*.
In Short: *Legend* offers extensive built-in control over typography and format, but its confusing and overly complicated menus, slow performance, and problems with memory management make it the least attractive choice among *Windows*-based word processors

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guides can be displayed or concealed.

By default, you enter text in a near-WYSIWYG mode that displays fonts, line breaks, and page margins, but also shows tiny visible codes that represent spaces, tabs, style tags, and paragraph endings. You can change the default to a full-WYSIWYG mode that displays the page exactly as it prints. Unlike other *Windows*-based word processors, *Legend* lets you view (in editable scale) the bottom of one formatted page on the same screen with the top of the next.

On a fast machine, *Legend* lets you input text at relatively high speed in WYSIWYG mode. For the fastest possible text entry, or for editing hidden text, index entries, and other text that doesn't print on the same page with the main text, you can switch to draft mode. This mode uses a large, startlingly ugly Courier-style font, and litters the screen with obscure style codes that are unidentified in the manual. The only way to figure out what a code means is to click to the left of it and consult a status line at the foot of the screen.

A FRUSTRATING MENU SCHEME

Legend's menu and command structure is obscure and overly complicated. The normal menu structure manages text within a frame, not the frames themselves. To manage frames, you click the right mouse button—the Text drop-down menu changes to a Frame menu, and the Styles drop-down menu changes to a Props (for Properties) menu. To create a new frame, you first click the right button to make the Frame menu appear, then choose Frame, Create, and finally select a Frame type. To size the frame, drag the mouse while hold-

STILL TO COME: More GUI Word Processors

by Edward Mendelson

In the spring of 1990, PC users can choose from more than 50 character-based word processors but only four GUI-based word processors. If one of those four isn't what you need, wait a few months. The number of graphics-based choices will almost double by autumn, and one of them, *XyWrite IV*, will be radically different from anything you've seen in *Windows* or OS/2's Presentation Manager.

As far as the market is concerned, the biggest news in GUI word processors is the scheduled arrival of *WordPerfect for Presentation Manager*, probably late in the third quarter. *PM WordPerfect* will be keystroke-compatible with character-based *WordPerfect* 5.1, and thanks to an agreement between WordPerfect Corp. and Lotus to shun the PM menu structure mandated by Microsoft, will share the essentials of its interface with *Lotus 1-2-3/G*.

Functionally, *PM WordPerfect* will match DOS *WordPerfect* feature for feature. Because DOS *WordPerfect*'s printer drivers can perform tricks that no other DOS, *Windows*, or PM application can perform, *PM WordPerfect* will use special WordPerfect-supplied printer drivers that will allow access to more than 1,700 characters supported by the program. If your printer's fonts don't include the character, the printer driver will generate it as a graphic.

PM WordPerfect won't add editing features to DOS *WordPerfect*, but it will be more convenient to use. The built-in file manager will display graphic thumbnail sketches of text and graphics files as you scroll through the list of filenames and you'll be able to keep the file manager on-screen while editing. The font menu, somewhat like *Ami Professional*'s style menu, will display a sample of each font as you scroll through the list of typefaces available on your printer.

PM WordPerfect will be followed by a *Windows* version, but no date has been set for its arrival.

MORE FROM MICROSOFT

Microsoft Word for Presentation Manager, due in the second part of the year, will be faster and spiffier than the *Windows* version, but otherwise virtually identical. If you know the *Windows* version, you'll be able to switch to the PM version without thinking twice. Microsoft made the early alpha version that I looked at an impressively quick performer, and the released version should be even faster.

The arrival of *Word for PM* will make it possible for corporate users to put a *Windows* version and a Presentation Manager version of the same program on different machines, without having to retrain users who switch from one to the other.

XYWRITE IV

With the rest of the world sliding precipitously into the happy valley of the GUI interface, *XyWrite IV* may be the only program that keeps the best of both worlds. The new *XyWrite*, due around the middle of the year, runs under plain DOS, not *Windows* or OS/2, yet it allows full WYSIWYG editing of text and graphics. You can enter text at full speed in ordinary character mode, then press a key, and watch the editing window transform itself in a fraction of a second into full-WYSIWYG mode. GUI word processors offer a draft mode for high-speed editing, but even the GUI draft mode is slowed down by the graphics screen. *XyWrite IV* promises no-compromise character-mode editing, combined with no-compromise graphics-mode editing. For many, the combination may prove irresistible.

Judging from the early alpha version, all the speed and features of *XyWrite III+* are retained in the new version, while an optional new menu system makes the program easier for new users to navigate. The keyboard has also been rethought for greater logic and clarity, and the program is generally better-integrated. The graphics features in *XyWrite IV* will also appear in a future version of Dragonfly Software's *Nota Bene*, with even greater functionality than in the original.

If you want character-mode and graphics-mode editing in the same program, *XyWrite IV* and *Nota Bene* may be your only choices for the indefinite future. While OS/2 1.*x* allowed programs to work in either graphics or character mode, Version 2.0 is reportedly a virtually all-graphics operating system. A program running under OS/2 2.0 will either have to use Presentation Manager or send simple teletype-style text to the screen. If you want character-mode word processing under OS/2, you'll find it in the DOS compatibility box—or nowhere at all. ■

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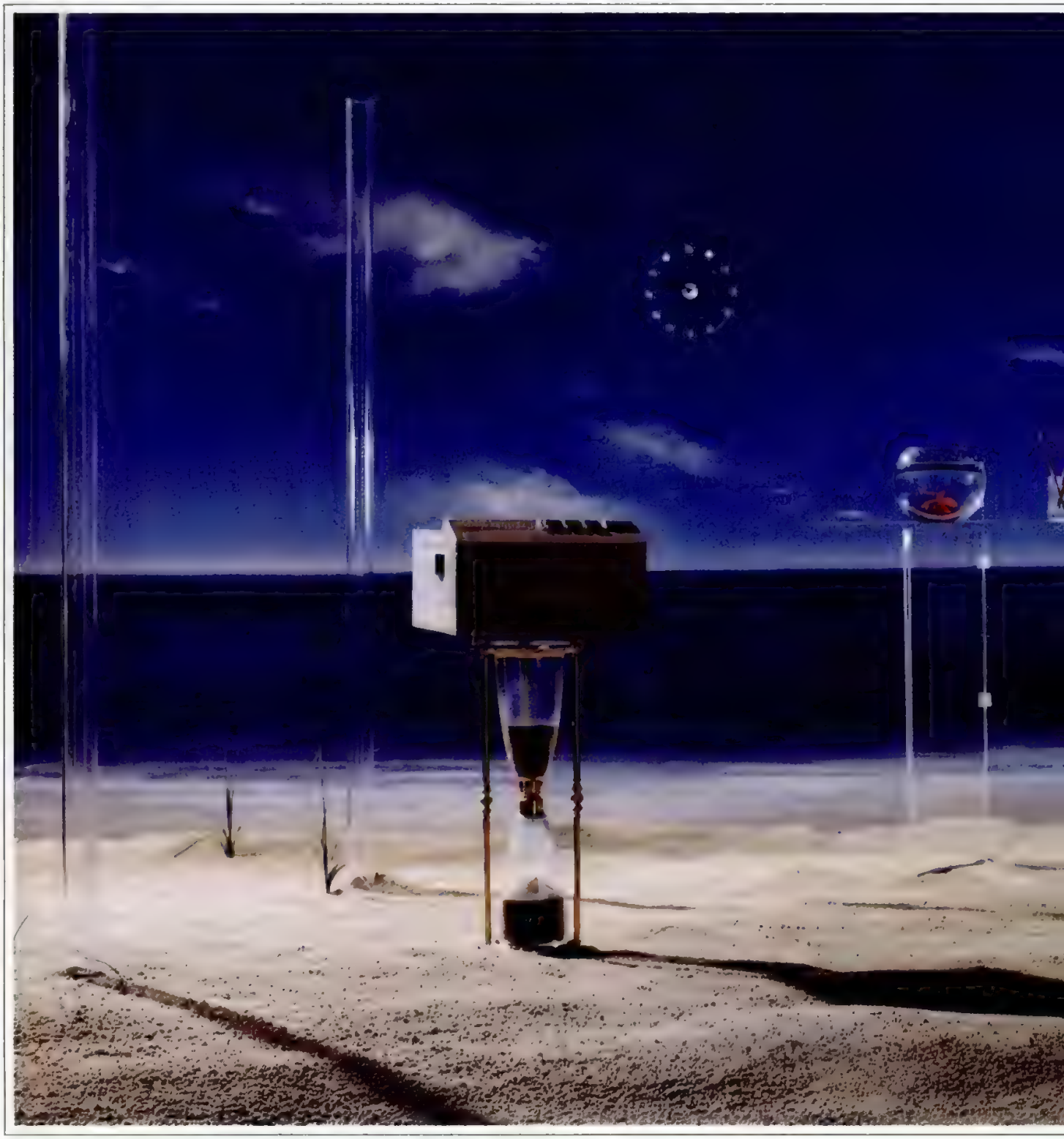

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PERFORMANCE TESTS: GRAPHICAL WORD PROCESSORS

The speed differences among these graphical word processors are slight except in isolated cases. Clearly, when making your choice, feature sets should be given much heavier consideration than relative speed.

The **Program Load** test times how long it takes to load the word processing program from the hard disk, from the moment the Enter key is pressed at the command line (with no parameters active) to the moment that keystrokes can be entered in the program.

The **Import File** test measures the time required to bring in the test file from the hard disk and have the word processing software convert it to the package's native format. Timing starts when the key is pressed to begin the import and ends when the file is on the screen.

In the **Save and Continue Edit** test, the file is saved to the hard disk while it is being edited. Timing starts at the moment the command to save is executed and ends when keyboard control is regained.

The **Save and Blank Screen** test adds a space to the beginning of the file, then saves the file and blanks the screen. Timing starts with the keystroke for saving the file and ends once the screen is cleared and the command line or menu is displayed. The space is added to make sure that "smart" programs (which can save faster when they detect that a file is unchanged) do not have a performance advantage.

The **Global Search-and-Replace** test performs an automatic search-and-replace to locate 100 occurrences of a word in the test document and replace each occurrence with another word. Timing begins on execution of the search and ends with the last replacement.

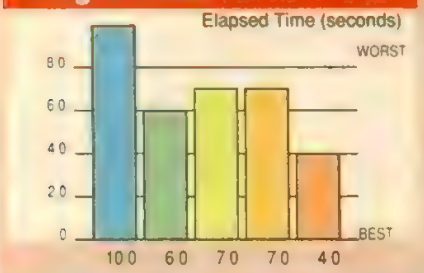
The **Search for Middle** test marks the middle of the document with the string "This is the Middle of the File," then searches for the string from the top of the file. Timing begins with execution of the search and ends when the string is located.

The **Top-to-Bottom Scroll** test times a scroll through the entire 50K document from top to bottom. The scroll command is issued by placing the cursor on the Scroll Down button in the Vertical Scroll bar. Timing starts when the mouse button is pressed and stops when the end of the file is reached.

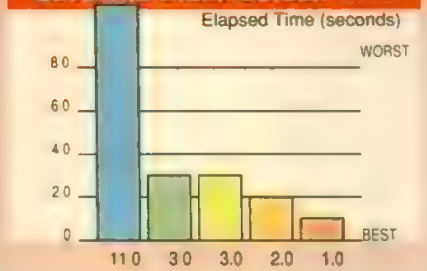
The **Merge Text** test inserts a 3K file into the middle of the main 50K document. Timing starts when the block is posted and stops when control of the keyboard is regained.

In the **Regain Keyboard Control After Print Command** test, the file is printed, and the delay is timed from the keystroke that executes the print command to the moment when control of the keyboard is regained.

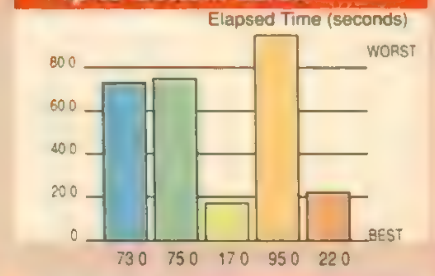
Program Load



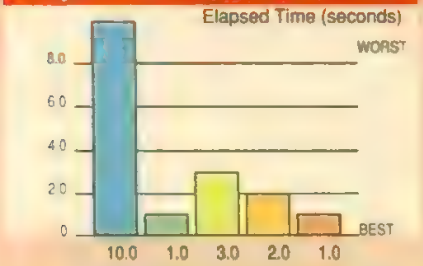
Save and Blank Screen



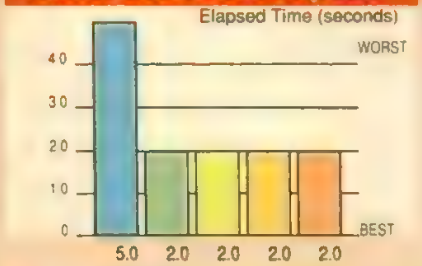
Top-to-Bottom Scroll



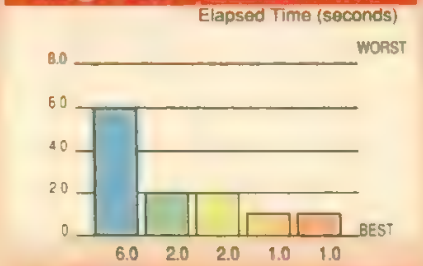
Import File



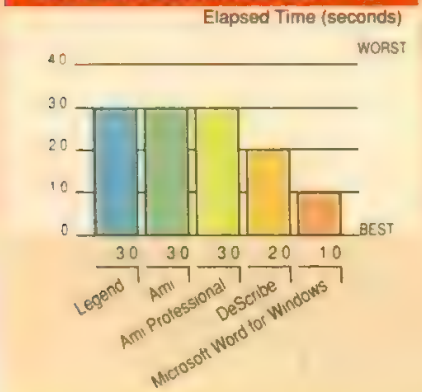
Global Search-and-Replace



Merge Text

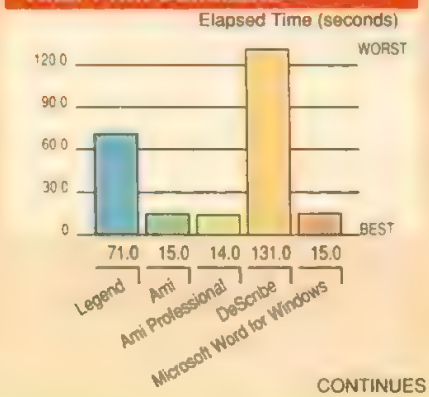


Save and Continue Edit



Search for Middle

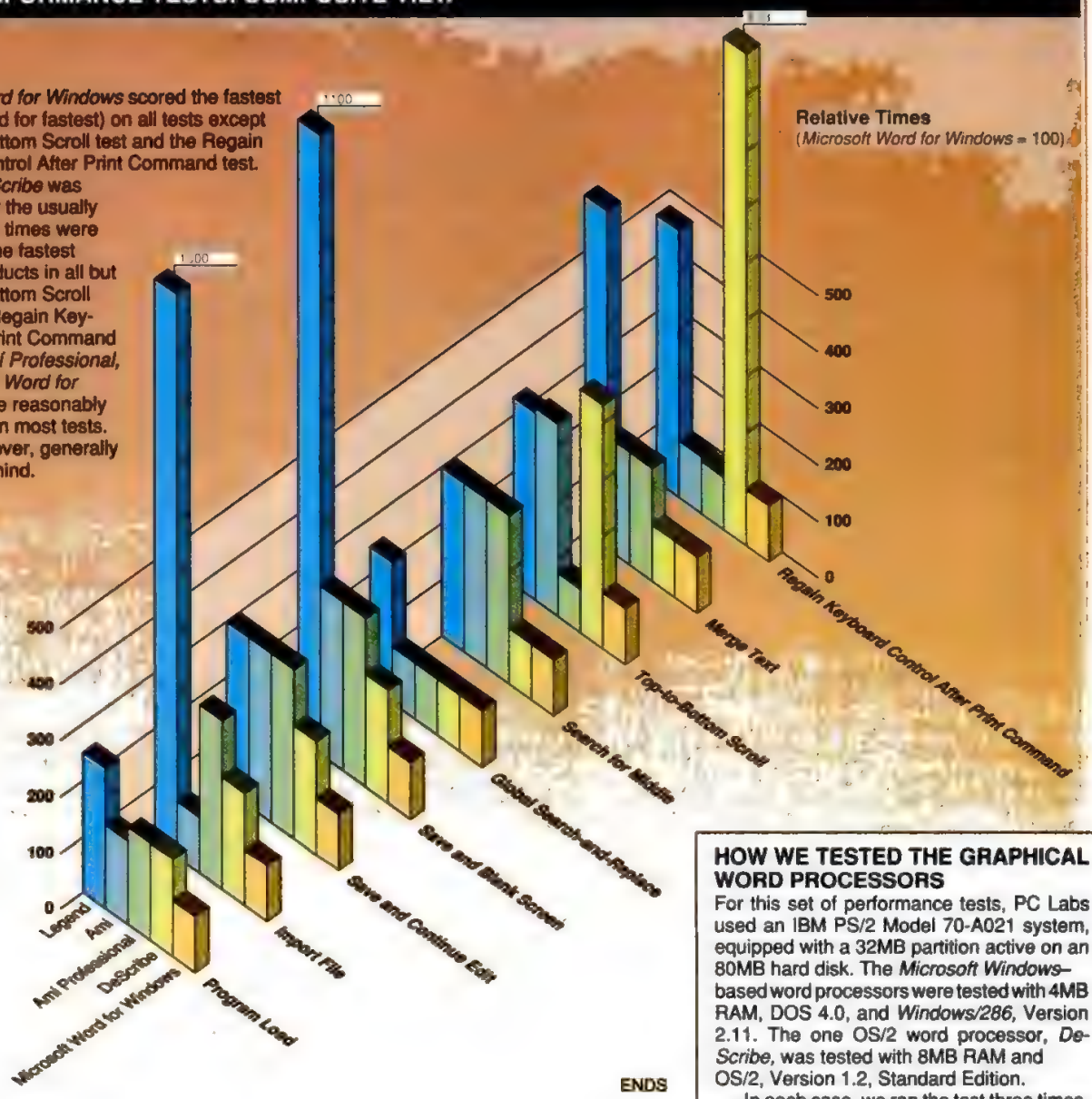
Regain Keyboard Control After Print Command



CONTINUES

PERFORMANCE TESTS: COMPOSITE VIEW

Microsoft Word for Windows scored the fastest (or at least tied for fastest) on all tests except the Top-to-Bottom Scroll test and the Regain Keyboard Control After Print Command test. Although *DeScribe* was running under the usually slow OS/2, its times were also among the fastest *Windows* products in all but the Top-to-Bottom Scroll test and the Regain Keyboard After Print Command test. *Ami*, *Ami Professional*, and *Microsoft Word for Windows* were reasonably comparable on most tests. *Legend*, however, generally lagged far behind.



HOW WE TESTED THE GRAPHICAL WORD PROCESSORS

For this set of performance tests, PC Labs used an IBM PS/2 Model 70-A021 system, equipped with a 32MB partition active on an 80MB hard disk. The *Microsoft Windows*–based word processors were tested with 4MB RAM, DOS 4.0, and *Windows/286*, Version 2.11. The one OS/2 word processor, *DeScribe*, was tested with 8MB RAM and OS/2, Version 1.2, Standard Edition.

In each case, we ran the test three times, clocked the test runs with a stopwatch, averaged the results, and rounded the score to the nearest second. Average times of less than a second were rounded up to 1.

ing down the right button. If you press the left button, you have to start over—even the technical support staff admits that they often press the wrong mouse button. Adding to the confusion, the menu changes again when you click the mouse in frames containing tables or graphics.

You constantly need to move from one drop-down menu to another to perform related tasks. To switch between near-WYSIWYG and full-WYSIWYG, you choose the Display menu, but to get to draft mode you choose the Text menu. Both the Style menu and the Props menu have a Create option for designing a new style for text or properties for a frame. But when drawing a frame, you also need to access the Frame Menu's Create option. For footnotes, you design the layout on one menu, the text style on a different menu, and create the notes themselves from a third menu. You'll get equally tangled by lists and indexes. You can use a ruler to locate tabs or create tables, but not text columns.

Many functions that should be simple are frustratingly complex. When you're finished with a search or replace, the Search menu remains on-screen with its title bar uncolored to indicate that it's no longer active. You might assume that Esc would remove it from the screen. It won't. You must either move the mouse to the menu and click on Done, or reactivate the menu using the same keyboard commands you used to open it in the first place, and then move to the Done button.

Legend's graphics import filters work well if they have enough RAM, but text

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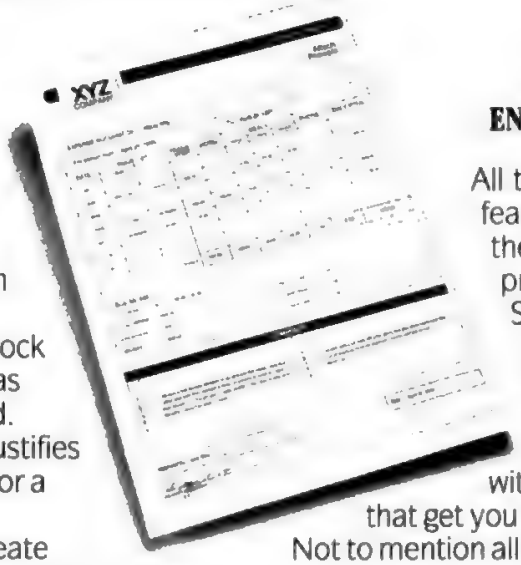

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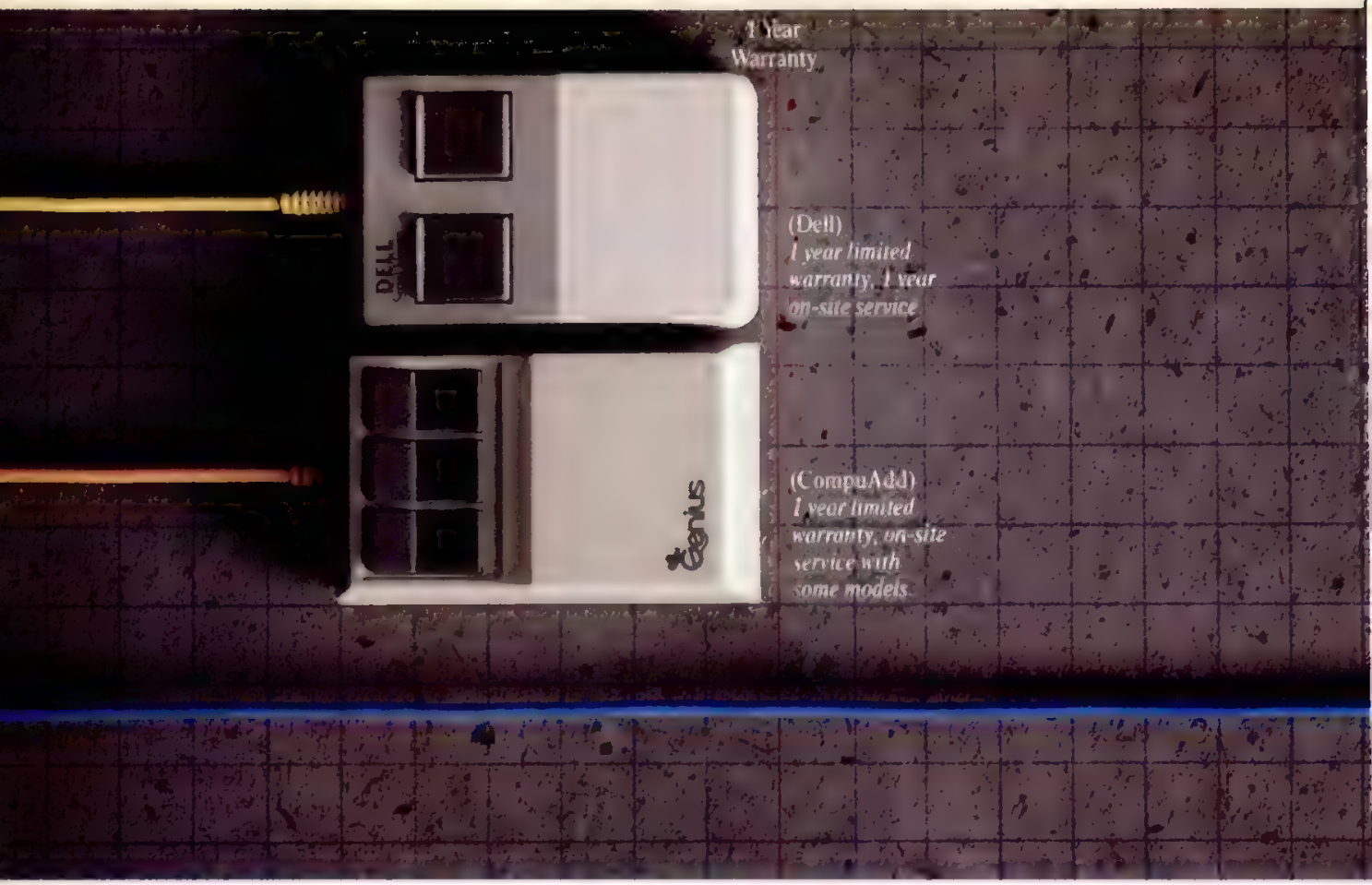

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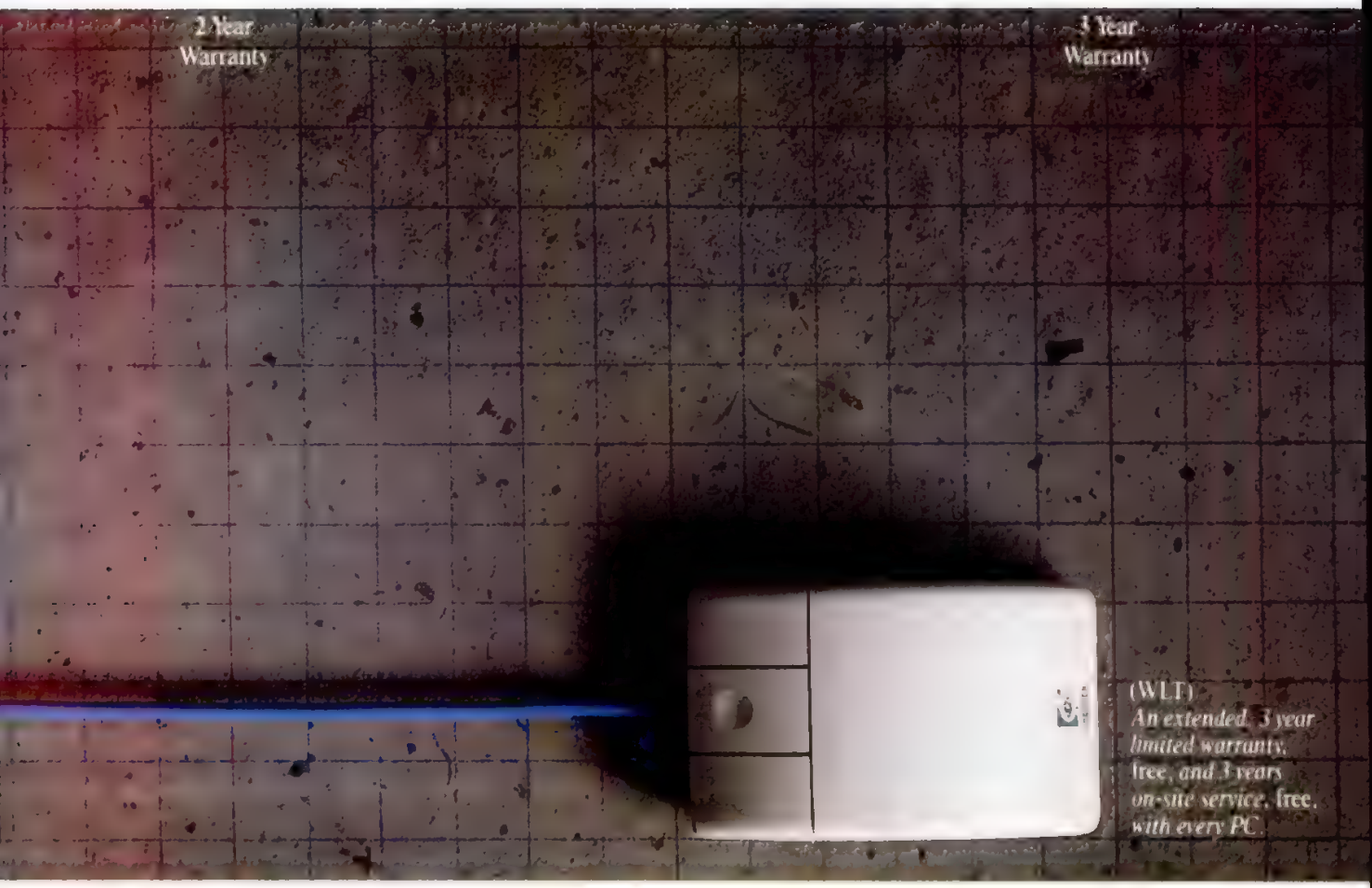

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import is sometimes strange. The *Microsoft Word* filter dropped most of the formatting from a simple document, yet it added a number to the start of every paragraph. To import ASCII files with carriage returns at the end of every line, you use the same "*Legend* text" filter that you use to transfer text from one *Legend* file to another. After importing text, you must remember to repaginate using the obscure Update Ending command.

On the PC Labs' timing tests, *Legend* produced the worst results of all the packages. This program doesn't exactly *run* under *Windows*—it tiptoes gingerly and hopes it doesn't bang its head on the memory ceiling. Unless you clear all TSRs from your system, you may find that you can't even open the file menu. If you manage to open a file, you may not be able to change formats or import graphics.

Legend is such a memory hog that installation creates a separate directory for use as a disk cache. On my system this directory rapidly filled with files left over from *Legend*'s frequent crashes when I tried to change printers with too little RAM or when I changed to a printer whose fonts the program didn't seem to recognize. *Legend* too often gets confused by its own formatting: once it jumped from one column to the next while I entered text instead of finishing the first column. The technical support staff was baffled.

A new version of *Legend* will appear some time after the release of *Windows* 3.0. If it builds on the current system's strengths while sorting out its bugs and inconsistencies, it will be worth serious consideration. Meanwhile, you have some powerful alternatives from which to choose.

Microsoft Word for Windows

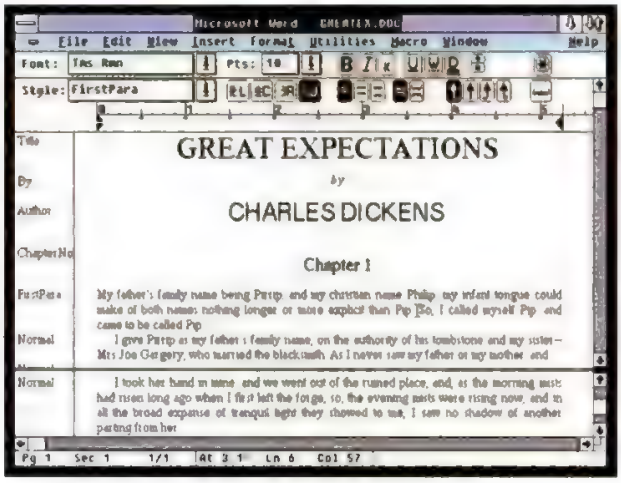
Graphics-based word processing hit maturity when *Microsoft Word for Windows* appeared on the scene. The $495 masterpiece is the first and only program that brings the full depth and richness of features found in the most advanced character-based programs to the GUI world. In fact, *Word for Windows* goes beyond merely challenging character-based word processors in a graphics environment; it introduces functions that, until now, were scarcely imaginable in any application. Almost all its features, both the familiar and the innovative, are implemented with an ease and elegance that advance the art of programming while simplifying the life of the user.

Word for Windows does more than any other GUI program to make formatting effortless. Using the icons on an optional gadget called a "ruler" at the top of the editing screen, you can select or create styles, adjust tabs, margins, column widths in tables, text alignment, and spacing—all without tediously switching between menus and text in order to see the results. You get a continuously updated display of the format at the point where you're working. An optional "ribbon" works the same way to let you select fonts, point sizes, and text attributes that go beyond the standard bold and italic to include small caps and continuous, broken, or double underlining. You can, of course, use keyboard shortcuts instead of icons, and for fine-tuning of leading and other advanced formatting, you'll need to open a somewhat complex sequence of menus.

Defining a paragraph style is almost embarrassingly easy. Merely use the ribbon and ruler to format a paragraph, click on the stylename box in the ruler (or press Ctrl-S), and enter a new stylename. You can add refinements via menus later.

Word for Windows's ribbon and ruler are only two of the elements of the screen that you can display or conceal. You can turn on a status bar at the foot of the screen and a vertical bar at the side that displays the names of styles used by each paragraph. You can add built-in or customized macros to any of *Word for Windows*'s menus, or move standard items from one menu to another. You can also switch among different ways of viewing the page. The normal editing view displays true line endings and shows you the top of one page and foot of the next, but it doesn't show the true position of snaking columns, headers, footnotes, or text wrapped around graphics. A slower "page view" displays all these features in their true position, but only on part of one page at a time.

You can hide or display hidden codes, but *Word for Windows* gives you no way of zooming in for a close-up look at the text. Unlike *Ami* and *Legend*, *Word for Windows* doesn't use frames to position text or graphics; instead, you use the mouse and ruler or specify locations via menus. An option lets you choose whether to display only the format elements that the printer can print or everything you've formatted into a document, even if you'll need a better printer to print them. Print preview is reasonably fast, and lets you edit margins and graphic locations, but only shows a reduced image. For top editing speed, you can switch to draft mode, which uses the *Windows* system font and shows minimal formatting.



Virtually all the optional features of the *Word for Windows* screen are shown here: the style bar (left), the ribbon and ruler (top), and the status line (foot). You can split the screen and edit different parts of the same file without scrolling through the document.

FANCY FIELD WORK

Word for Windows's most impressive innovation, the one that really takes it beyond character-based applications, is its use of fields. These are codes that you include in a document to tell the program to manipulate text or graphics, or prompt the user to enter text or make decisions.

A primitive example of a field is the code found in most character-based programs (and in GUI programs like *Ami Professional*) that automatically inserts the current date or filename into the text. *Word for Windows*'s fields move far beyond such Stone Age functions. They can report

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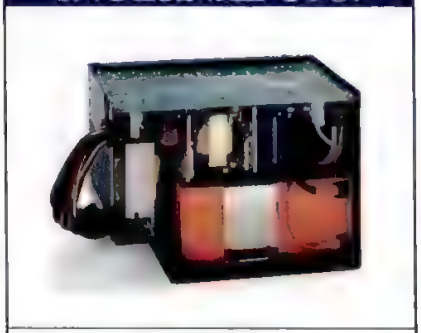

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the amount of time used in editing a document, convert numerals to words, copy text into dictionary-style headers, transfer data via DDE links, and even run a macro or jump to another part of the file when the user clicks on them. Fields let you create "master" documents that include separate, shorter documents. They also combine in one consistent and efficient syntax all of *Word for Windows*'s functions for creating numbered lists, indexes, tables of contents, cross-references, and outlines—although simpler menu shortcuts are almost always available.

By combining the fields with macros you can create documents (and templates for building other documents) that are as interactive as a video game and far more productive. Templates can include fields, glossaries, and macros. *Word for Windows* supports macros that will run automatically whenever you create, open, or print a file. In a corporate setting, this means you can write macros that guide the user through the whole process of creating

ENVIRONMENTAL AWARENESS

by Abe Rosner

Word processors, like the ones evaluated here, are evolving into full-fledged document processors that are able to interact with other applications and import all kinds of information smoothly. By taking advantage of the graphical environments in which they operate, these programs are less-constrained than their DOS-based cousins.

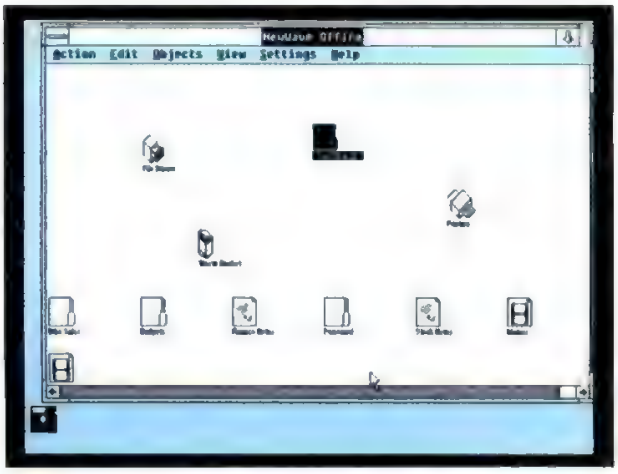
Four of the five products we review—*Ami*, *Ami Professional*, *Word for Windows*, and *Legend*—run under *Microsoft Windows*. This graphical environment provides these packages with benefits like WYSIWYG displays and DDE links. But even though they employ a GUI environment, *Microsoft Windows* is still DOS-based, and it has all the limitations of that operating environment. The most painful limitation is that applications must run within the 640K memory constraint in real mode. *Windows/286* utilizes expanded memory, swapping to handle multiple applications and memory intensive programs; *Windows/386* can also use expanded memory. It reserves a block of RAM up to 640K for each application; with a 386 or 386SX processor, each of these virtual machines can access expanded memory segments. This lets you run large applications in each virtual machine, but the same constraints that apply to *Windows/286* sessions apply to *Windows/386* when multiple sessions are running.

Microsoft's new *Windows* 3.0 has the ability to implement single application sessions in up to 16MB of extended memory in protected mode (when you use an application compliant with *Windows* 3.0 specifications). That's a great leap forward.

RIDING A NEW WAVE

Hewlett-Packard's *NewWave*, Version 1.0, is an object-oriented interface that runs over *Microsoft Windows/286*, Version 2.11. *NewWave* lets you view any application that meets its specifications as an object. Thus, *Ami Professional*, *Microsoft Excel*, New Media Graphics' *Video NewWave*, Channel Computing's *Forest & Trees*, and other programs can be intertwined into a total office system.

Not only can information be shared among applications via DDE, but by using *NewWave*'s agent facility—a macro tool that triggers events with each object—a system that interfaces your word processor with e-mail, full-motion video, and your database can be seamlessly designed. Using *NewWave*, you can produce a document on-screen that responds to information on-line and shows the appropriate video in an object box when you hit a button. Information entered into a spreadsheet can automatically trigger appropriate forms from a word processor or database that must be sent out, and there is no need for the user to worry about the other products necessary to perform the task. Versions of *NewWave* are slated for OS/2 and other releases of *Windows* in the near future.



HP's NewWave operating environment treats each application as an individual object so your programs work together seamlessly.

OS/2 ADVANTAGES

OS/2 (which hosts *DeScribe*, the fifth word processor reviewed here) has all the advantages of *Windows* 3.0 with the added benefits of threads (sets of memory registers that depict the status of a process). An OS/2 process can have multiple threads that may be shared by other processes. As with *NewWave*, a system can be designed to use multiple applications from various vendors to perform a job. For example, you can be filling in your database's data input screen in a foreground session, while in the background a nicely formatted document is printing and a spreadsheet is updating its information.

It's easy to see how the word processor of the future will become an integral part of a wider system that allows users to maintain and update their documents without having to perform a series of repetitive tasks or difficult importations. Multitasking operating systems like *Windows*, *NewWave*, and OS/2 will make it happen. ■

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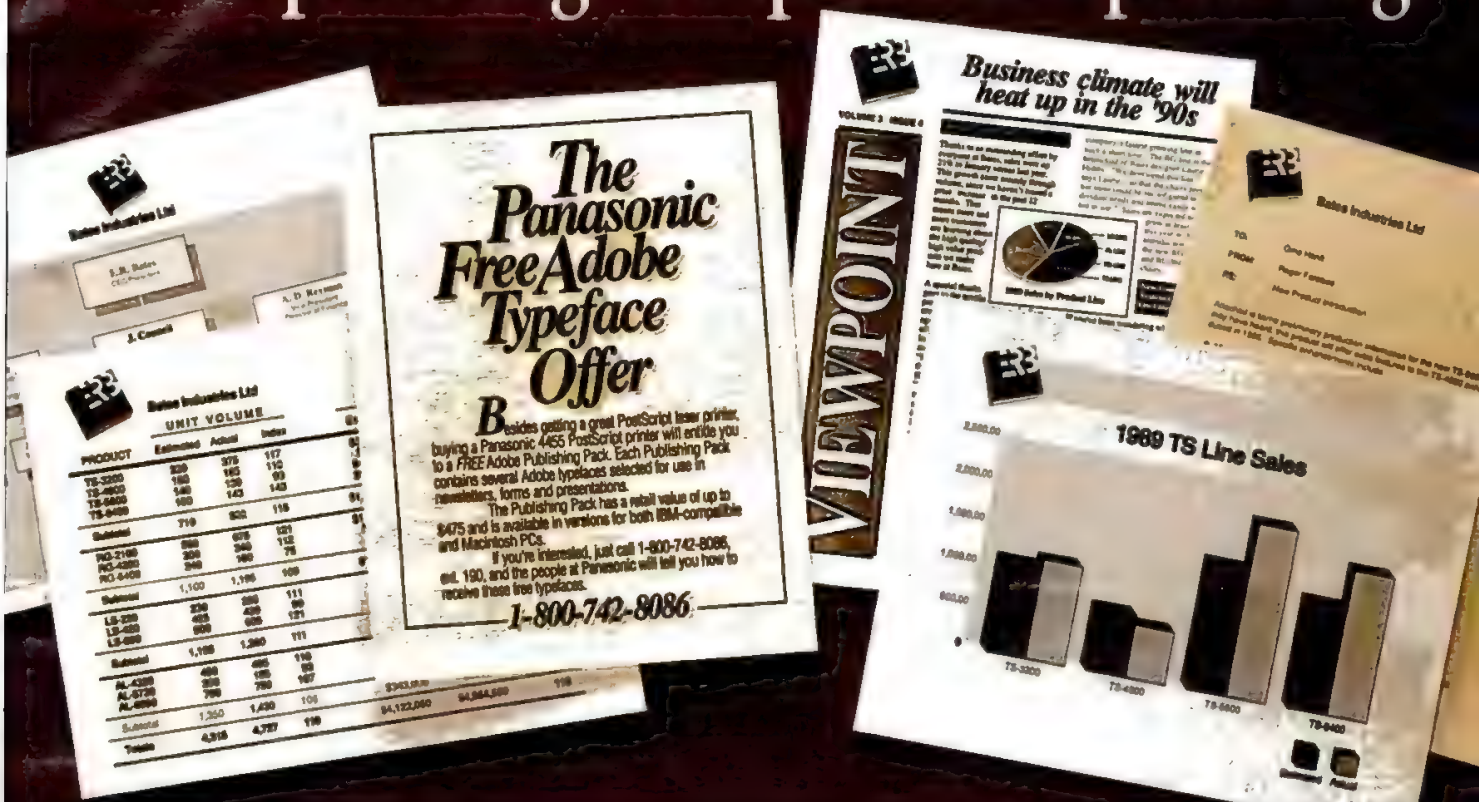

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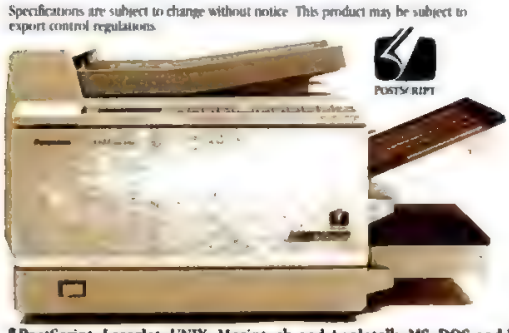

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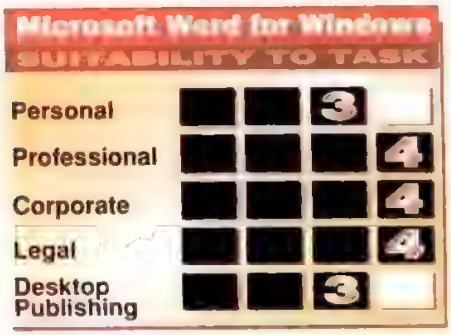
or revising a document. Macros can alter the menus to match the skill of the user or the complexity of the document.

To learn all the complexities of the WordBASIC macro language, you'll need a $20 technical reference that's sold in bookstores, but most of its contents are in a disk file that comes with the program. A small macro industry has already begun to thrive on bulletin boards and on the MSAPP forum on CompuServe.

Word for Windows comes with a superb automated tutorial. Unlike most *Windows* applications, *Word for Windows* offers online help that actually helps. And if you're puzzled by the complex screen, press Shift-F1 to turn on a "help pointer" that you can position over an icon or command to get an instant explanation.

THE DOS WORD DIFFERENCE

If you're familiar with the character-based DOS version of *Word*, *Word for Windows* will take little time to learn. The two programs share similar structure and procedures, although they aren't keystroke-compatible and *Word for Windows* lacks the two-letter Alt-key style commands familiar in DOS *Word*. *Word for Windows*



goes one better than DOS *Word* by letting you open nine documents at once, but it shares DOS *Word*'s indispensable ability to split a window and edit two parts of the same file at the same time. A macro included with *Word for Windows* can even install the DOS *Word* keystrokes.

Word for Windows uses DOS *Word*-like glossaries for text and graphics, and adds a special glossary entry called the Spike that, unlike the *Windows* clipboard, lets you accumulate bits of text and graphics and insert them in your file at one time. *Word for Windows* improves on DOS *Word*'s already excellent outlining by letting you manipulate collapsible outlines with the mouse or icons in addition to keystrokes. *Word for Windows*'s speller, however, is even weaker than the mediocre one in DOS *Word*, but the thesaurus provides simple definitions that can help you refine meanings while you write.

Some crucial features of DOS *Word* are absent in *Word for Windows*. The *Windows* version lacks division styles and character styles. This means, for example, that you can't use *Word*'s fields to create dictionary-style headers for the pages of a real dictionary. *Word*'s dictionary-style headers pick up the first or last text on the page that's formatted with a specific style, but you can use styles only to format full paragraphs, not the boldface keyword of a dictionary entry. Microsoft is committed to adding character and division styles to *Word for Windows*, but you should prepare for a long wait.

Word for Windows's DOS *Word* ancestry produces benefits not found in other GUI word processors. To maintain consistency with DOS *Word*, Microsoft broke some of the least sensible rules of its own *Windows* environment. In most *Windows* applications, if you define (or select) a block and then touch the Spacebar, the block disappears, because the rule in *Windows* is to replace the selection with the character typed at the keyboard. In *Word*, the same sequence of keystrokes sensibly adds a space (although you can choose the *Windows* convention if you prefer).

Similarly, in most *Windows* applications you can extend a defined block (or selection) only by holding down the shift key and using the mouse or direction keys. This normally makes it impossible to extend the block by searching for a string, because you would end up entering only capital letters in the search menu. In *Word for Windows* you can extend the selection with the same freedom you have when editing.

Word for Windows isn't trammeled by some of *Windows*'s usual limitations. It tends to be notably faster than any comparably ambitious *Windows* application, and was the clear winner in virtually all of PC Labs' timing tests. Top speed in the *Windows* environment, however, doesn't mean fast enough. Even on a 33-MHz machine, some of *Word for Windows*'s operations, especially with files using complex formats, are slow enough to send you back to a character-based program. *Windows* 3.0 (with which *Word for Windows* is already compatible) will knock down some of the walls that slow the word processor to a crawl, but not enough of them.

More than most *Windows*'s applica-

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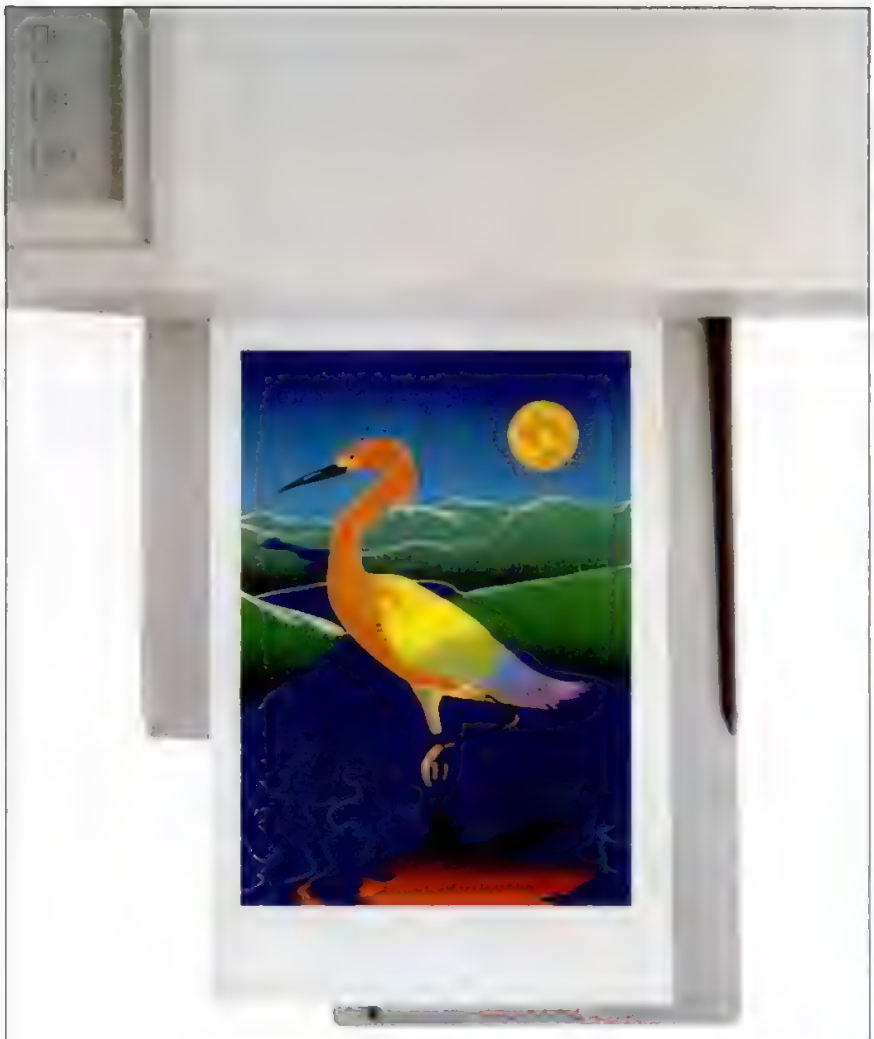

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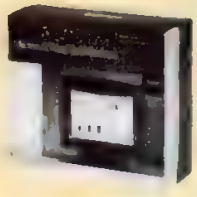
CIRCLE 218 ON READER SERVICE CARD

tions, *Word for Windows* is designed as much for the keyboard as the mouse. The keyboard template is crowded with conveniences, including a nifty one that lets you glide a paragraph around your text by pressing Shift-Alt-Up or -Down. You can even turn off the scroll bars to move through your file using the direction keys.

Among the dozens of other well-implemented features in *Word for Windows* are revision tracking, file comparison, sorting, programmable merges, tables with complex formulas, math operations in text, and equation editing. Instead of automatic timed backups you can tell the program to make periodic offers to back up a document. You can import and resize major graphic formats, but you don't get the drawing and charting tools that *Ami Professional* gives you. You insert lines via paragraph formatting, and you can create boxes that expand as text flows into them. *Word for Windows* imports most major word processor and spreadsheet formats, but surprisingly, it doesn't automatically strip carriage returns from the end of each line in an ASCII file. You have to write a macro to do the job for you.

One major inconvenience is that you have to write macros to do many things that you should be able to do from menus. If you want *Word for Windows*'s file menu to display the same directory every time you open the program, you have to write

FACT FILE
EDITOR'S CHOICE



***Microsoft Word for Windows*, Version 1.0**
Microsoft Corp., One Microsoft Way, Redmond, WA 98052; (800) 426-9400, (206) 882-8080
List Price: $495.
Requires: 640K RAM, hard disk, 80286 processor or higher; 1MB to 2MB EMS memory, *Microsoft Windows*-supported graphics adapter, DOS 3.0 or later. Mouse recommended. Ships with a runtime version of *Windows*, but the full version of *Windows* 2.11 or higher is recommended.
In Short: *Word for Windows* has all the functions of DOS-based *Word* and more, in an interface that's simpler to use. The most innovative of GUI word processors, its macros and templates allow for an unprecedented degree of automated document creation. Its visual design is exceptionally lucid and convenient.

CIRCLE 399 ON READER SERVICE CARD

an autoexec macro to do the job. This is too much to ask of novice users.

Word for Windows also has some limits in its control over printing, especially compared to *WordPerfect*. Letter spacing can be expanded or compressed in a defined block or a style, but you make the adjustment by points. You can only compress the space between pairs of letters by 1.75 points. You can't create separate settings for word spacing and letter spacing. *Word for Windows* does nothing to overcome the limited number of characters you can print from *Windows*, although an ingenious but slow macro lets you enter standard symbols. In print preview, you can't jump to the last page of a file—you must scroll through every page.

Word for Windows's excellent outlining lets you manipulate collapsible outlines with the mouse, icons or keystrokes.

The only serious bugs I encountered in *Word for Windows* were those that affected printing and DDE links. With some printers, the em dash overlapped the following character. With boxed text on a LaserJet II, some words broke into two lines although they displayed as one line in print preview and every other view. As for its direct DDE links to *Microsoft Excel*, imported numbers are rounded to the nearest whole number, which means that those between 0 and 1 will appear in Word only as 0 *or* 1. This bug doesn't affect cut-and-paste transfers.

These are trivial problems compared with the complexity of the program, and the first release of *Word for Windows* is probably the most bug-free of any major application in recent years. Few programs are powerful, intuitive, and reliable. *Word for Windows* is all this and more. ■

John Dickinson *is executive editor of west coast operations at* PC Magazine. **Edward Mendelson** *is a contributing editor of* PC Magazine. **Abe Rosner** *is a project leader at PC Labs.*

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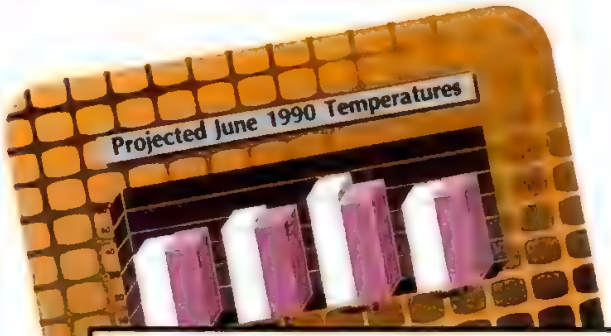


Multimedia is a hot topic in the news these days, but is it ready for prime time? To find out, *PC Magazine* dips into this fluid and changing world, comparing five multimedia authoring systems for producing interactive business presentations.

COMPUTER ILLUSTRATIONS CHARLES CONOVER

by Robin Raskin

Ask anyone in the know for a definition of multimedia and you're bound to get a collection of personal, often self-serving, visions. In its broadest sense, multimedia refers to the delivery of information in intuitive, multisensory ways through the integration of hitherto distinct media—text, graphics, computer animation, motion video, and sound—in a single presentation under the control of the computer. But the ways of doing this are still in a state of rapid and confusing evolution.

Today, multimedia all too often means multiheadaches. Creating a multimedia application requires a hodgepodge of heterogeneous tools, a walloping dose of technical expertise, the ability to think about information in multidimensional ways, and, last but not least, a sizable investment in a powerful computing platform and complex peripherals.

So why should a hard-headed business person be interested in it? Simple. The pie in the sky is plummeting to earth. In our age of information overload, the benefits of superb imagery and high-fidelity sound become increasingly clear: they allow us to experience information rather than simply acquire it.

By now you may have caught a glimpse of the multimedia future. A Marcus Welby look-alike appears in an on-screen window to coach a medical student in a simulated gall bladder operation. An executive gets stock information from an on-screen video news feed while animated business graphics simultaneously provide company statistics. An art historian delivers a memorable sound-and-sight presentation on Renaissance art right to the desks of her students.

But how do you get from here to there? In this issue, *PC Magazine* takes a hands-on comparative look at five multimedia authoring systems—the software environments that glue together multimedia's disparate elements. Though these aren't the alpha and omega of multimedia by a long shot, they do sit at the center of things. Our tour of them will show you how the pieces of the multimedia puzzle fit together.

A PLATFORM, NOT A PRODUCT

Multimedia computing is fueled by the rapid development of digital technology. Now that computers incorporate text and graphics as a matter of course, it's but another step to the inclusion of photorealistic images, sound, and motion video. As digital CD players, digital cameras, digital VCRs, and, eventually, digital high-definition television take hold in consumer electronic markets, the previously segregated worlds of television, audio, and computing become intermingled in a single universe of bits and bytes.

Yet it will be a long time before you'll find multimedia applications all nicely shrink-wrapped under "M" on your dealer's shelves. Multimedia is not a product, nor even a technology. It's better seen as a platform—a combination of hardware and software elements that together support a multisensory information environment. Someday these components may be standard equipment in everyday PCs. But today, multimedia is very much a raw frontier in which tools and skills are mixed and matched depending on the sources you want to incorporate into your presentations.

FROM PROCESS TO PRODUCT

So what can you do with a multimedia? Historically, multimedia technologies found their first significant application in computer-based training (CBT). Learning to assemble a machine or to understand a complex procedure requires visual realism, which CBT courses achieve by deliv-

DIGITAL VIDEO ARRIVES

by Nick Arnett

High-quality, efficient digital video compression is the Holy Grail of multimedia computing. The prospect of selling millions of computers that offer television's uncanny ability to grab attention and motivate is highly attractive both to computer companies and consumer electronics companies. Whoever wins will sell a lot of hardware one of these days, so it's not surprising that developers are busy working on digital video standards.

ON THE VERGE

Today, the front-runner in digital video is Digital Video Interactive (DVI), a compression and playback technology originally developed by RCA's Sarnoff Research Institute and eventually acquired by Intel Corp., which has taken over the DVI research team and the responsibility for developing DVI and bringing it to market.

DVI is not a compression technique per se, but a brand name for a set of processor chips that Intel is developing to compress video onto disk and to decompress it for playback in real time at the U.S. standard motion video rate of 30 frames per second. The chip set includes both a pixel processor, which performs most of the decompression and also handles special video effects, and a display processor, which performs the rest of the decompression and produces the video output.

DVI's greatest long-term advantage is that its microprocessors are programmable, so it can be adapted to a variety of compression and decompression schemes. The data can even be programmed to tell the DVI processors how it was encoded, so that multiple compression schemes can be used on the same disk.

Intel officials say that DVI will support as many as six types of compression in the next few years. The current standard it uses is a proprietary technique called *region coding*, which works by identifying the areas of a video image that can be reduced to a small number of bits of data. DVI also saves space by interframe compression, a technique that eliminates the parts of a moving picture that don't change between frames.

Compressing the video without losing a substantial amount of information takes a lot of horsepower. To gain the highest quality level of which DVI is capable, you must perform the compression on a specialized parallel-processing system, for which Intel charges $250 per finished minute of video. Once this is done, the results can be stored on a CD-ROM and played directly from the CD-ROM disk by any PC equipped with a DVI playback board. Thus, in this mode, DVI is an asymmetrical system.

For those who need a symmetrical arrangement, Intel now offers the ProMedia 750 a set of boards for about $5,000 that let you both compress and decompress video on the same PC-based system. This *real-time video* is of lower quality than the *production-level video* that Intel produces off-line, a necessary tradeoff to bring processing requirements within the scope of an ordinary PC. Moreover, real-time video doesn't use interframe compression, so it can't store as much video per megabyte. But it's good enough for many uses. And, it can be stored on ordinary hard disks and distributed over computer networks, so it's an important option for authoring and for in-house applications like digital teleconferencing.

Intel's goal is to put a $1,000 playback board on the market next year,

ering controlled video segments from a videodisk, reinforced with audio cues at appropriate points. The student navigates the information at his or her own pace, while the system maintains a progress record. Until fairly recently, CBT was the province of specialized turnkey systems such as IBM's *InfoWindows* and Sony's *Views*, but manufacturers are now making their audio and video boards and their authoring systems available on standard PCs.

Business presentations, broadly defined, make up the other area in which using multimedia makes sense. Television-like images and realistic stereo sound add drama to standard presentations. More important, integrating video and audio in a single computer makes it possible to create interactive presentations that offer information on an as-you-need-it basis instead of a whether-you-want-it-or-not basis. Such presentations can be tailored for various viewing audiences—from a group with a live presenter to a standalone system in a kiosk or point-of-purchase environment.

The future holds even more exhilarating prospects: animated visualizations and digital teleconferencing, even a new form of electronic publishing in which collaboratively created works fuse text, art, animation, video, and audio in a compound document accessible over computer networks.

> Multimedia is not a product, nor even a technology—it's a platform.

And don't forget entertainment. The interactivity and sensory richness that multimedia offers may well be the deciding factor that finally puts a computer into every home. New CD-based multimedia standards are being driven by this potential gold mine, but in the meantime, stay tuned for games and educational simulations geared to new machines like Fujitsu's FM-Townes and Tandy's 2500XL, which package CD-ROM drives or videodisk players, stereo sound, and other multimedia components in a low-priced package for the consumer market.

PLAYING CATCH-UP

The PC may be the king of business computing, but it lags a bit in the multimedia field. As of today at least, the Apple Macintosh sets the standard. The Mac's integral graphical user interface, its built-in sound chip, and its well-defined standards for sharing graphic information make it an attractive platform for multimedia soft-

with the video input board available for another $1,000. The company forecasts steady improvement in picture quality coupled with fairly rapid price declines. By 1992 or 1993, Intel hopes to offer a high-quality symmetrical system for a few hundred dollars.

THE ALTERNATIVES

Compact Disc Interactive (CD-I) is most often mentioned as DVI's major competitor, but in fact it's a different approach altogether—and as yet one that has little relevance to the PC world. CD-I is being developed primarily by Philips, with partners Sony and Matsushita, which are carefully positioning it as a consumer product.

In its initial release, CD-I will come in the form of a custom system based on a Motorola 68000-family processor and a proprietary real-time operating system. It should be available in the first quarter of next year for about $1,000. Philips, whose American Interactive Media subsidiary is directing CD-I software development, is focusing on educational and entertainment applications.

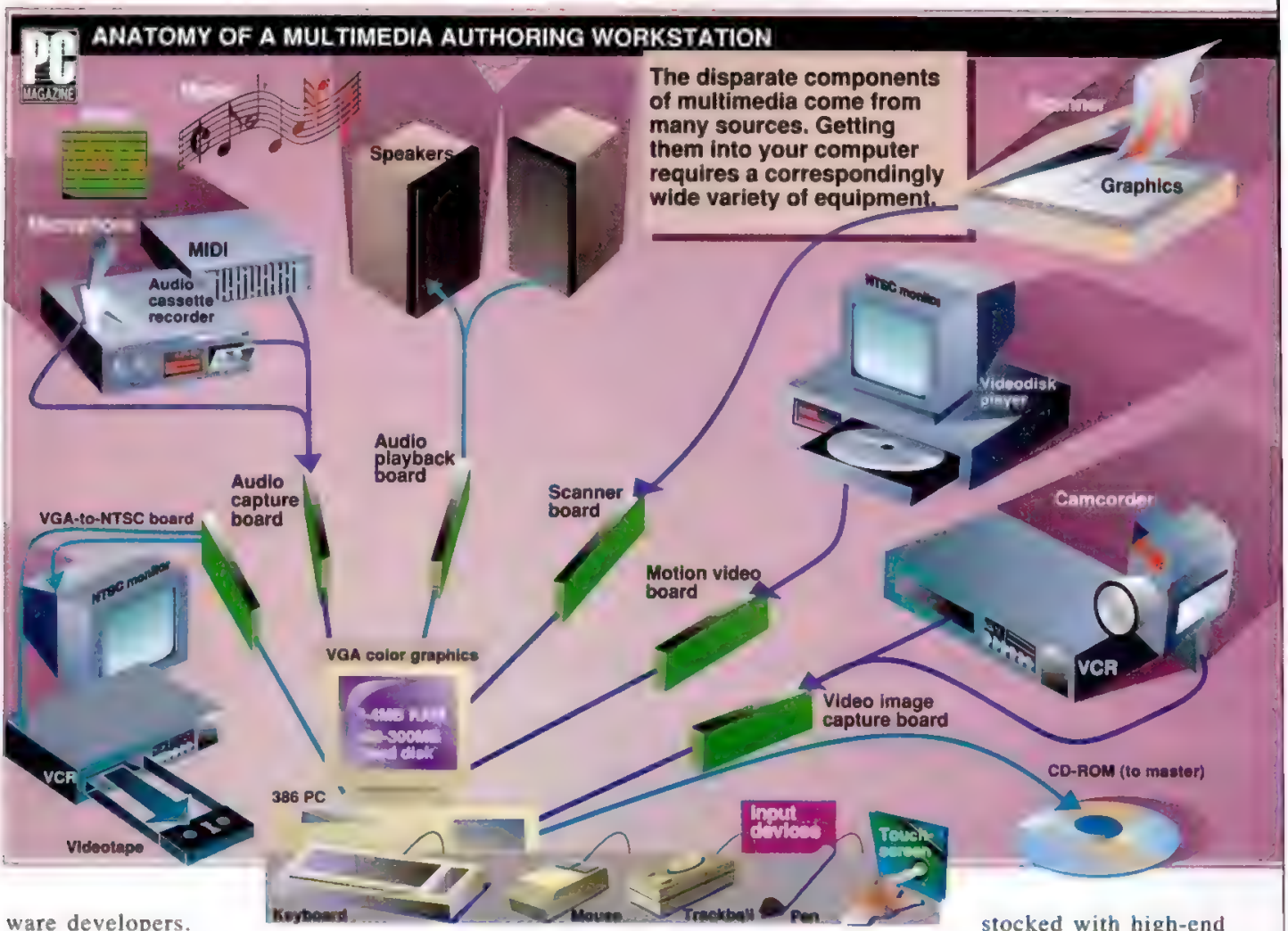
DVI isn't the only digital video standard that applies to PCs, however. A new class of compression chips based on an international standard called JPEG (Joint Photographic Experts Group) supports very high-quality video images for applications such as random-access video editing. The first JPEG chip set has already been announced by C-Cube Corp. of San Jose, California, and others are expected in the next few months.

JPEG chips will simplify the storage of color images, bring electronic cameras into the digital realm, and allow the networking of color printers and scanners. But the JPEG standard's ability to compress moving images is limited because it's primarily intended for still color-image compression and hence does not take advantage of interframe compression. Nor does JPEG specify standards for audio.

To get over these limitations, JPEG has spawned a sister committee, called MPEG (Moving Pictures Experts Group) to work on a standard for motion video. With members from a wide variety of computer and telecommunications companies, MPEG is striving for a symmetrical system.

The MPEG committee appears to have settled on a video compression technique called Discrete Cosine Transforms, which uses a complex mathematical algorithm to eliminate redundant data in square blocks of pixels. This is believed to have the potential for the highest resolution at the highest compression rate, but the facts won't be known until the standard is fully developed. The first MPEG chips are not expected to be built before mid-1991, and products would follow late next year or in early 1992. By that time, Intel plans to support MPEG compression standards on its DVI chips.

The best news about JPEG and MPEG is that they're international standards, and their compression technique is compatible with the main teleconferencing standard. If they become established, they should eventually be as widely accepted as facsimile standards, with, presumably, the same impact on price. Just as fax machines dropped from $10,000 to under $1,000 because of widespread world demand, JPEG capability, which next year will probably command a $300 to $500 premium in a personal computer, should drop to under $50 in a couple of years. MPEG can be expected to follow the same kind of curve starting in late 1992. ■



ware developers. Thus, while the PC has a plethora of authoring programs, none go as far as MacroMind's *Director* on the Macintosh, which uses a score metaphor that lets you choreograph graphics, sound, and animation sequences in a common workspace (see the sidebar "A Peek at the Competition").

Less visible but equally notable is Commodore's Amiga. Engineered with NTSC-compatible video hardware, custom graphics chips, and digital sound support on the motherboard, the Amiga has acquired a devoted following among animators and desktop video producers. It supports a sizable number of multimedia tools, and specifies common file formats and compression standards for animations as well as for still graphics.

Achieving an equivalent level of multimedia support on a PC today means sifting through dozens of potentially incompatible product add-ons. But a huge installed base cheers it on. And though the PC's open, flexible architecture creates the possibility of conflicting standards, it also makes a better platform for custom solutions. Future developments will give the next generation of PCs a leg up, but in the meantime, if you plan to use the PC as a multimedia platform, count on a certain amount of rolling your own.

THE MULTIMEDIA TOOLBOX

Before the elements of a multimedia application can be assembled, they must first be brought into the computer in a suitable form. The skills needed to do this work on a PC are disparate, and you'll need a correspondingly wide variety of tools.

Text and graphic images are the easiest to handle, as their standards are the best-defined. Most authoring systems have only limited drawing capabilities, relying instead on images imported from other applications or scanned in through affordable desktop scanners. Thus a shelf well-stocked with high-end paint programs, drawing programs, type manipulation tools, and graphics file translators, is indispensable to the multimedia developer.

Animation, as simple as a bar chart that grows before your eyes or as complicated as an architectural walkthrough, adds another dimension to the process. *Autodesk Animator*, at the forefront of low-cost PC animation, offers a wide variety of animation tools for the creative-minded, including canned optical effects, cel animation, and tweening (where the movement between key frames is computer generated). Paul Mace Software's GRASP offers more professional-level animation tools.

Getting sound into your PC requires an audio capture board, which converts the analog input generated by a microphone or cassette recorder into a sampled digital waveform that can be stored on your hard disk. The best of the lot use digital signal processor (DSP) chips more efficient sampling, and some boards can bring synthe-

A MENU OF COSTS

PC equipment	
Baseline: 386 PC, 2MB RAM, 100MB hard disk, VGA	$3,000–$6,000
High-end: 386 PC, 4MB RAM, 300MB hard disk, VGA	$4,200–$7,500
Multiscanning monitor	$1,500–$2,300
Color flatbed scanner	$2,500–$15,000
Video equipment	
Video image capture board	$499–$2,000
Motion video board	$2,400
VGA-to-NTSC board	$850–$1,800
Videodisk player	$1,000–$3,000
Recordable videodisk player	$5,000–$6,000
VCR	$450–$1,200
NTSC monitor	$800–$1,300
8mm camcorder	$1,000–$2,000
Audio equipment	
Audio playback board	$99–$1,000
Audio capture board	$1,900 up
Microphone	$50 up
Audiocassette recorder	$100 up
Speakers	$40 up
Software	
Multimedia authoring system	$500–$2,500
Drawing software	$500
Paint software	$100–$500
Graphics file conversion software	$50–$300
Miscellaneous	
Videodisk mastering (one side, 10-day turnaround)	$800–$1,800
Recordable videodisk recording unit	$10,000
CD-ROM mastering (includes 100 disks)	$1,800
CD-ROM premastering equipment (recommended for complex productions): Meridian Data CD-Master, including simulation software and 600MB hard disk	$30,000

Prices for video equipment based on list price information from Sony Corp.

sized digital sound in directly through a MIDI interface. Unfortunately, the complete lack of standards forces developers to support audio hardware case-by-case.

SNAPSHOTS

It's video that makes multimedia sizzle, but incorporating conventional broadcast television signals into computer-based presentations is the most problematic area in multimedia computing. Today, PCs and video devices belong to separate worlds, with different standards for scanning rates and resolution. Bridging the gap requires

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an array of special hardware devices.

The easiest and most straightforward way to handle video is to treat it like graphics. Using one of a number of image capture boards on the market, you can take a freeze frame from any video source, be it VCR, a video camera, a videodisk player, or even a live feed, and store it as a file on your hard disk where it can be treated like any other graphics file. The Targa file format, first generated by TrueVision's Targa videographics boards and now supported by a range of Targa workalikes, has become something of a de facto standard for captured video images. Targa files can be converted to standard PC formats.

MOVING PICTURES

Bringing in motion video requires a different strategy. You can achieve a facsimile of motion by a method analogous to computer animation: capturing a series of successive video frames and playing them back more or less rapidly, usually between 10 to 15 frames per second. But though this approach can successfully incorporate small "movies" into a presentation, it quickly breaks down on bigger jobs.

The reason is as simple as elementary arithmetic. At the U.S. broadcast rate of 30 frames per second, 1 minute of high-quality full-motion video requires something on the order of 2 gigabytes of storage. Without compression technology to squeeze this megabyte-gobbling imagery into a smaller space, digital video is ridiculously impractical. Hence the importance of video compression and decompression schemes such as Intel's DVI (see the sidebar "Digital Video Arrives").

VIDEODISKS RULE

In the meantime, the best source of motion video input is the analog videodisk. A mature technology with proven reliability, these 12-inch platters can hold up to an hour of high-quality full-motion video, plus two audio tracks that can be played separately or together. CAV-type videodisk players designed for use with computers afford fairly quick random access to individual frames, and their cost is reasonable: suitable players from Sony, Pioneer, Panasonic, and others can be had for as little as $1,000.

The limitations? videodisks are bulky, read-only affairs. Though the cost of mastering a videodisk for low-volume use has come down tremendously over the last few years, producing the video source with conventional equipment still takes a considerable outlay. While a few videodisk recorders are available from TEAC, Sony, and others, they cost on the order of $10,000, and their disks are incompatible with standard videodisk players.

Though videodisks are easily controlled through a standard serial port, their NTSC video output is incompatible with PC video standards. Therefore, getting video on your PC screen requires you to add a motion video board to your computer to convert the signals. Older-model boards, such as the Sony SMI-3081, simply let you play the video source on your PC monitor, but a new breed of more-sophisticated boards lets you play video in a window, to clip it, scale it, overlay it with computer graphics, or even to impose a variety of special effects such as mosaics, elongations, or split screens (see the sidebar "Multimedia by Videodisk: Motion Video Boards for the PC").

> Before the elements of a multimedia application can be assembled, they must first be brought into the computer in a suitable form.

AUTHOR, AUTHOR!

Authoring systems are the tie that binds these multiple media together. PC authoring systems are as individual as their developers, but most take a flowchart approach that lets you specify the elements you'd like to incorporate and string them together in the order you'd like them to appear. Specify transitions from one image to another or create animations using clip or frame animation techniques. Motion video is integrated by specifying the beginning and end points of each video clip, and video tools let you overlay titles and text atop it. Audio control ranges from simple playback from a videodisk audio track to complex musical notation systems.

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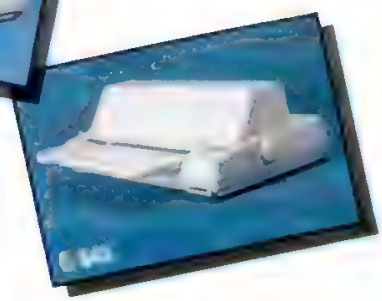

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Interactivity is one of multimedia's chief selling points, and most authoring systems let you specify branch points and conditional events where users can make choices about how to proceed with the presentation. The most flexible authoring systems use hypermedia concepts for maximum user control over the information. While hypermedia systems do best at handling text and graphics, their object-oriented design lends them to audio and video presentations as well: clicking on a hypertext button can play a sound or video clip just as easily as it can display a picture or jump to a text window.

STORE AND DELIVER

With its high-resolution graphics and sound files, multimedia makes unprecedented demands on storage space, and these demands will only become more acute as digital video hits the scene. While large hard disks are useful for authoring and for limited in-house distribution over local area networks, CD-ROM is the best bet today for distributing multimedia applications widely. WORM drives, erasable CDs, magneto-optical drives, and other exotica offer the possibility of denser and cheaper storage in the future.

Though they are strictly read-only, CD-ROMs hold more than 600MB of data in a rugged, compact package, and their drives can be added to standard PCs at a reasonable cost. CD-ROM mastering costs much less than it used to, thanks to low-cost prepublishing software from companies such as Reference Technology and Meridian Data, and to service bureaus that offer off-site mastering facilities at reasonable fees.

The High Sierra format that CD-ROMs use specifies only data, not audio or video. CD-ROM XA (Extended Architecture) interleaves data with compressed audio on the same disk. CD-ROM players modified to support CD-ROM XA are currently under development, and Microsoft plans to support it as a multimedia delivery technology on PCs. A more ambitious standard, CD-I, which includes specifications for compressed motion video as well as for sound and data, is also under development, but it won't appear on PC platforms, at least in the short term.

The use of CD-ROM presumes that you're delivering the presentation on a PC equipped with the appropriate audio and video equipment. This is excellent for one-on-one presentations or small groups, but for large audiences, consider the videotape—the cheapest and most compact way to integrate audio, video, and computer graphics—though not a very flexible or interactive one. VGA-to-NTSC converter boards with built-in genlocking make it relatively easy to record your PC-based presentations on videotape—and even to overlay them on a live video source.

MORE TALK, MORE PRODUCTS

The next year or so will be a tumultuous scene of activity in the PC multimedia arena. The big news is DVI; the first commer-

A MULTIMEDIA GLOSSARY

by Steve Rosenthal

Asymmetric system A video system that requires more equipment to store, process, or compress a digital image than it needs to play that image back. Intel's Digital Video Interactive (DVI) system and the Philips/Sony CD-I system are asymmetric in their full fidelity modes.

Authoring system The development environment used to create a multimedia project or presentation. It is not necessarily needed for playback (see Delivery system).

CAV and CLV The two main ways of recording video on videodisks. In the CAV (constant angular velocity) method, the rotation speed of the disk stays constant, while with the CLV (constant linear velocity) method, the rotation rate changes to keep data on the disk passing the laser pickup at a constant rate. CAV videodiscs are capable of random access and therefore are the type generally used for interactive multimedia applications.

CBT Computer-based Training—the use of computers for interactive instruction, education, and training. An important use for multimedia.

CD-I Compact Disc Interactive—a standard for CDs that lets you integrate data, still graphics, audio, and motion video on the same disk.

CD-ROM XA Compact Disc Read-Only Memory Extended Architecture—a CD format that adds interleaved audio to data within the basic CD-ROM format.

Color key A color-based video overlay method that lets you drop all areas of a selected color out of a foreground image so that the corresponding areas of the background image can show through it. Also called *chroma key*.

Composite video A video signal that combines all the color and timing components of the picture in a single input line.

Delivery system The hardware and software needed to play back a multimedia presentation. It is often less costly and less sophisticated than the system required to create the presentation (see Authoring system).

DSP Digital Signal Processor—a specialized computer chip designed to perform speedy and complex operations on digitized waveforms. Useful in processing sound and video.

DVI Digital Video Interactive—Intel's proprietary technology for putting full-motion video on CDs and magnetic media at a very high level of compression.

Frame In video and videographics, a complete picture.

Full-motion video Said of video sequences or systems that provide enough images per second to afford the illusion of smooth motion. Often defined as the rate of U.S. standard video signals (30 frames per second).

cial products incorporating these processor chips from Intel should appear by the time you read this. Topping the list is Intel's ProMedia 750, a matched set of real-time video boards that can be used for authoring and playback. The compression board, which you'll need for playing multimedia presentations from CD-ROM or your hard disk, costs $1,995 with 1MB of RAM or $2,495 with 2MB of RAM; its companion video capture board, necessary only if you need to record motion video onto your hard disk, costs $2,150.

Intel's DVI boards will be supported by new or revamped authoring systems from CEIT (*Authology MM*, $4,500) and Network Technology (*Mediascript*, $1,500), as well as by updated versions of Intel's own authoring tools and software libraries. Time Arts is already selling a version of *Lumena*, its high-end paint program, that developers can use to edit high-resolution DVI-standard images; the basic version is $1,500 and the production-level version costs $2,500.

GIANT MOVES

The major vendors in the PC world continue to hammer out their multimedia strategies. IBM's far-flung empire, whose marketing efforts have coalesced under the umbrella of a single Multimedia Solutions group, has many multimedia projects in the works. An enhanced version of its Audio Visual Connection authoring system, which will support the new M:Motion board, is expected by fall. In the longer term, IBM is working closely with Intel to promulgate the DVI gospel and has expressed a notable interest in using DVI chips at the board level in future PS/2s, fueling rumors that it is preparing a line of competitively-priced "multimedia PCs" sporting multimedia features such as CD-ROM, touch-screens, and stereo sound. Though IBM is close-mouthed on this subject, you can reasonably expect to see concrete evidence of this new breed of machines sometime in 1990.

> CD-ROM is the best bet today for distributing multimedia applications widely.

Meanwhile, Microsoft is starting the enormous task of retrofitting *Windows* and OS/2 Presentation Manager to support multimedia data structures. Microsoft representatives say that we'll see "multimedia extensions" for *Windows* late in 1990 or early in 1991, and that the same code will be incorporated into the OS/2 environment at some unspecified future date. These extensions will appear to applications as device drivers or dynamic link libraries, letting developers link multimedia

Genlock Short for synchronization generator lock, a feature that allows a video system to set its timing to match the timing of an outside signal, and so to overlay one signal on top of the other or to smoothly combine them.

Hypermedia A method of information delivery that provides multiple connected pathways through a body of information, allowing the user to jump easily from one topic to related or supplementary material, which may be in text, graphics, audio, or video form.

Interlaced video A video format that creates images by first drawing out every other line in the image as one field, then sweeping down the screen again to fill in the intervening lines. This method is used for broadcast-standard NTSC video because it lets images be created with relatively low signal rates, but with computer video it often results in unacceptable flickering on sharper transitions.

JPEG Joint Photographic Experts Group—a working group established to develop a standard for compressing and storing still images in digital form, or the proposed standard under development by this group (see MPEG).

MPEG Moving Pictures Experts Group—a working group established to develop a standard for compressing and storing motion video and animation in digital form, or the proposed standard under development by this group.

NTSC An abbreviation for National Televison Systems Committee, the industry group that formulated the standard for U.S. color television. NTSC signals (today, those meeting the equivalent RS-170A standard) use interlaced scans and 525 horizontal lines per frame at a rate of 30 frames per second.

Overlay To show one image superimposed on another. Especially in video images, to show text on top of a picture or computer output on top of moving video (see Genlock).

PAL The format for color television signals used in West Germany, England, Holland, and several other countries. It uses an interlaced format with 25 frames per second and 625 lines per screen.

RGB Video signals that use three signal lines to carry the red, green, and blue portions of the picture information.

SECAM A format for television signals used in France, the U.S.S.R., Eastern Europe, and other countries. It uses an interlaced image made of 625 lines at 25 frames per second.

S-video Separated video—a video signal format that puts the *chroma* (color) and *luminance* (brightness) information on separate signal lines instead of in a single composite signal. Super-VHS videocassette recorders rely on S-video for improved quality.

Symmetric system A video system that is capable of both storing and playing back compressed digital images (see Asymmetric system).

Targa A trademark of TrueVision Inc. for one of its lines of videographic display boards. More loosely, it refers to the file format (supporting 262,144 colors out of a palette of 16.7 million at 512 by 512 resolution) that was established for use with these boards and is widely used in the multimedia field.

Videographic Video adapters, monitors, and other computer output equipment designed to connect computer video systems to broadcast-style video systems. ■

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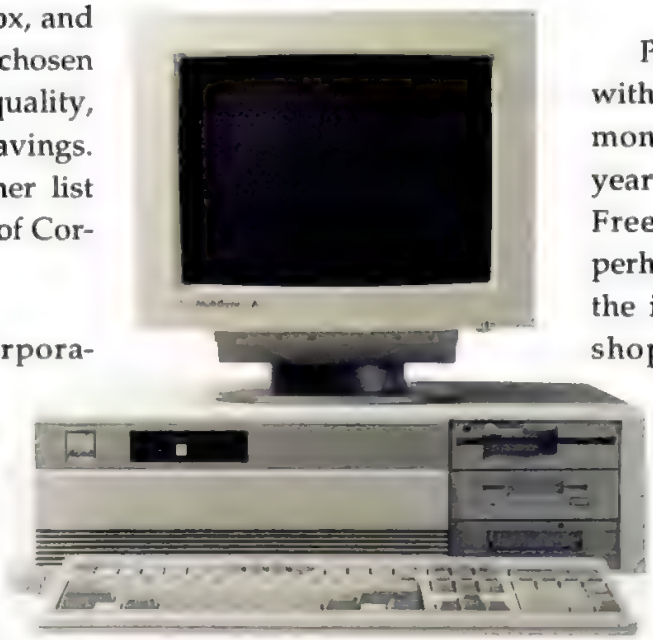

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subroutines into them at runtime. Microsoft has also licensed the *Director* playback technology from MacroMind and says that it intends to incorporate it into *Windows*, and has established alliances with other developers as well.

Some of what Microsoft intends to do is already available in Hewlett-Packard's *NewWave*, an object-oriented extension to *Windows* that offers a number of useful benefits to multimedia developers. *NewWave*'s Object Manager treats all elements—text, graphics, video, and audio—simply as objects regardless of their origins, and its Agent can automate operations involving multiple applications without knowing specifically about them. *NewWave* drivers for a number of multimedia boards have already been announced.

As this list makes clear, the groundwork is being laid for a day in the not-too-

A PEEK AT THE COMPETITION

by Steve Rosenthal

Though multimedia is just beginning to get off the ground on PCs, it's already flying high on Apple's Macintosh and Commodore's Amiga. Because both these platforms have built-in hardware support for coordinated images and sound, as well as a respectable installed base of machines, they've attracted a growing catalog of multimedia authoring tools. Both also host a good range of music creation and editing programs, and with the right software and interface hardware, both can be used to control videodisc players for interactive presentations.

The Macintosh wasn't originally designed as a multimedia machine, but even its low-end models offer the basic requisites for simple multimedia applications. Two programs especially have brought the Macintosh to the top of the multimedia stack.

STANDARD EQUIPMENT

The first, of course, is Apple's *HyperCard*, the "software erector set" that comes bundled with every Macintosh. *HyperCard* combines a database, scripting language, screen design editor, and a sound-and-image playback sequencer all in one simple program. Because it's object-oriented, graphics, sound, and animation sequences can be incorporated as easily as text, making it a natural for getting one's feet wet in multimedia. Its simplicity makes it a good prototyping and development tool for people whose primary focus isn't computers, but it's also useful to professional multimedia designers, and for creating training and academic courseware.

HyperCard has merited the sincere flattery of imitation. Silicon Beach's *SuperCard* and Spinnaker Software's *Plus* are largely compatible supersets of *HyperCard* that offer color, larger card sizes, and a larger number of script commands. Apple also has an upgrade in the works, but delivery of *HyperCard* 2.0 isn't expected until at least this summer.

MacroMind's *Director* is the current hot program for making animated presentations combining images and sounds from other programs, as well as for creating fancy product demonstrations. It uses a mixed playscript and score metaphor in which music-like notation coordinates the activities of "actor" objects and sequences that you create or import into the program. This design lets you create anything from dancing snakes to lettering that zooms and rotates in time with a musical accompaniment. A new, even more powerful version of *Director* should be shipping by the time you read this.

Other multimedia offerings on the Mac run the gamut from the AI-based *MacSmarts* from Cognition Technology through the tutorial *Point of View* from Scholastic Software. For quick product demonstrations and tutorials, Farallon Computing's *ScreenRecorder* is gaining a strong following. Several other companies make Mac-based multimedia authoring systems, with Authorware's *Authorware Professional*, Edudisc's *Mentor*, and TeleRobotic's *Course Builder* among the better known.

HIGHLY PRESENTABLE

On the Commodore side of the house, the Amiga has been best known for its computer-to-video hardware links. It now supports a growing number of respectable software packages. Amiga titling and animation packages have been popular in both industry and small-scale television production, but Commodore has particularly high hopes for its new authoring program called *AmigaVision*, which was just about ready for release at the time this article went to press.

Much like AimTech's *IconAuthor* on the PC or *Authorware Professional* on the Mac, *AmigaVision* lets you create a teaching or training document by dragging icons that represent actions onto a page to form a flowchart. The program then "plays" your presentation by following the flowchart from top left to bottom right.

The elements you can work with include display options (such as showing a graphic or block of text), control options (such as playing a video clip on a videodisc drive), navigation options (including loops and subroutines), and inputs (such as reacting to user inputs such as mouse clicks or keystrokes). If you have a touchscreen, *AmigaVision* will use that as well. The program even has its own modest database.

AmigaVision has a limited ability to create simple display screens directly in the program, but it's really meant to be used in conjunction with other graphics, sound, and writing products. With the Amiga's multitasking operating system, it's easy to bounce back and forth between *AmigaVision* and a product such as Electronic Art's *DeluxePaint III*. *AmigaVision* even lets you select different types of images and different screen modes for each screen you display.

The Amiga supports close to half a dozen other software packages that let you arrange sound and picture for multimedia presentations. Along with *DeluxePaint III*, they include *Animation: Sound Track* from Hash Enterprises, *The Director* from Right Answers Group, *MovieSetter* from Gold Disk, and *Photon Video: Cel Animator* from Micro-Illusions. ■

distant future when computing with audio and video will become as natural for us as computing with text and graphics is now. 1991 should be the pivotal year, but in the meantime, enough is already out there to get started.

EDITOR'S CHOICE

• Too Early to Call

Though our tests show that multimedia has arrived on the PC, they also show that it's not well enough developed to warrant an Editor's Choice designation this year. Hardware dependencies, graphics import difficulties, video complexities, and user-interface deficiencies make all of these products problematic purchases for most business users. Their generally high prices are another hindrance to widespread use.

But if you're in the market today and you're prepared for what's in store, you can make some reasonable choices. If your goal is interactive multimedia presentations, *Instant Replay Professional* deserves an honorable mention: it performed best on our test presentation, and its software is reasonably priced. You should be aware, however, that it is exceptionally complex and works only with one type of motion video board. In the long run, a better choice may be *IconAuthor*, whose user interface is far clearer—provided that its *Windows* 3.0 version does indeed solve its memory-management problems, as the vendor claims it will.

Presentations aren't the only way to use multimedia. Though the above two systems are versatile enough for building training systems, CBT systems like *Quest* and *TIE* offer special support for scoring and evaluation; they may be worth a look if this is your goal. Finally, though *Guide* looks weak in our test presentation, don't discount it in the kind of text-rich hypermedia applications to which it's best suited.

By next year, further development of standards and the emergence of a significant group of DVI products should make your choices easier. In the meantime, watch this space: multimedia is in your future.

The Reviews

Multimedia today embodies some fuzzy platforms, a potpourri of products, and some rather vendor-specific solutions. To narrow the focus to a manageable field, we structured our evaluation of authoring systems around a typical multimedia application—an interactive presentation that incorporates graphics images, soundtracks, animation sequences, and motion video clips (see the sidebar "Evaluating Multimedia").

To be reviewed in this issue, an authoring system had to let you combine text and graphics with sound and full-motion video at 30 frames per second from a videodisk player, and it had to offer some kind of branching facilities to let you move around within the presentation.

We found five products that fit the bill and were available for testing in time. *IconAuthor*, from Aimtech Technology, and *Instant Replay Professional*, from Nostradamus, were designed to create interactive multimedia presentations incorporating animation as well as sound and video. Two other products, *Quest*, from Allen Communications, and *TIE* (Training Icon Environment) from Global Information Systems Technology, are primarily computer-based training systems but have the basic features needed to do interactive presentations as well. The fifth, *Guide*, from Owl International, is a hypermedia product whose videodisk support and integral programming language make it suitable for some multimedia authoring jobs.

THE ONES THAT GOT AWAY

Our initial testing plan included a sixth product, (*Showcase*, from California Synfuels Corp.), but we were unable to complete our review of it because we could not get it to work with our Sony videodisk players in time. Another CBT system, *TenCore*, from Computer Teaching Corp., was not ready at the time we tested, nor were two additional hypermedia products with videodisk support, Knowledge Garden's *KnowledgePro for Windows* and Asymetrix's *Toolbook*. IBM's Audio Visual Connection (see "The Audio Visual Connection: Turnkey Multimedia from IBM," May 15, 1990), though a major multimedia presentation product, did not support motion video from videodisks at review time.

Our focus on interactive presentations eliminated two authoring systems designed to create computer-based non-interactive presentations: neither *Animax*, from Visionbase, nor *Prometheus*, an Italian product marketed in this country by Software Clearing House, had branching facilities or videodisk support at review time. Finally, since we wanted to review products that use a standard computer video environment for both creation and playback, we eliminated a range of high-end animation and video production tools that rely on Targa or Vista boards and dual-monitor setups.

NO EASY WALK

If there's one thing we learned from our testing experience, it's that multimedia authoring is not for the faint of heart. The authoring systems we tested are all large integrated packages that are far too complex for the casual user. Their prices reflect this orientation: they range in price from several hundred to over two thousand dollars, not including the costs of proprietary sound and video boards.

All of them are remarkably egocentric. Each has its own philosophical bent, its own arcane terminology, and its own modus operandi for working through the script of a presentation. With *IconAuthor*, you build a flowchart of your presentation by assembling and linking on-screen icons. As befits their CBT origins, *Quest* and *TIE* make student lessons and course terminology the backbone of their approaches, while *Instant Replay* uses a whimsical lexicon in which you actually "touchdown" objects. With *Guide*, you have to think of your presentation in hypermedia terms, which can take a significant mental adjustment.

Above all, none of these products was perfect for the task we put to it. Though some of the barriers can be finessed by resorting to built-in programming languages and external procedures, the perfect tool for multimedia authoring doesn't yet exist on the PC platform. If you're in a buying mood, you'll want to carefully compare the strengths and weaknesses of these packages with your requirements—and count on spending a lot of time evaluating and learning before producing useful presentations.

Guide

by Robert C. Ullrich

If this were a *Guide* hypermedia presentation, you might click your mouse pointer on the word "hypermedia" and a pop-up window would appear with a definition. Need more information? Click on "Owl," and a pop-up window containing OWL International's address and phone number would appear. *Guide* is a $495, *Windows*-based system designed for creating hypertext applications. But its audio and videodisk support makes it suitable for developing some multimedia applications.

BUTTON CRAZY

The hypertext applications for which *Guide* is designed let you assign areas of the screen on which a user can click to receive instant information about that topic. This is a good way to present some multimedia presentations, such as how-to, installation, or repair procedures, that incorporate graphics and video to explain text. *Guide*'s tools are well adapted and easy to use for such tasks.

Any area of the screen can be defined as one of five different types of hypertext buttons. The simplest of these is a Note button, which simply calls up a text window. Expansion buttons let you point to the items of an outline or index and open text windows on that subject. Command buttons run external programs, letting you play sounds or run videodisk clips. Finally, Reference buttons let you link text to text in other windows, while Link commands tie together the various parts of *Guide*'s presentations. *Guide* uses pop-up windows to define and set the parameters for each type of button.

In addition to its buttons, *Guide* comes with LOGiiX, a Pascal-like programming language that gives you an extra measure of flexibility. LOGiiX lets you run other programs from within a *Guide* presentation, and it lets you create canned presentations. It also lets you use *Windows*' Dynamic Data Exchange (DDE) facility to exchange data in real time with other *Windows* applications. This can be a useful feature if your presentation depends on live data, such as that from an *Excel* spreadsheet.

GRAPHICS LIMITATIONS

In spite of this flexibility, *Guide* is limited in its support for interactive multimedia presentations like our test presentation.

Our PC Labs test contained a number of 16-color PCX images, but since *Guide* comes only with *Windows*' standard eight-color driver, these could not be imported. In the end, we were forced to convert the images to eight colors, and to live with their correspondingly diminished attractiveness. In practice, you're better off creating your images in eight-color format in the first place, but while you can resize or crop graphic images within *Guide*, you cannot create or modify them.

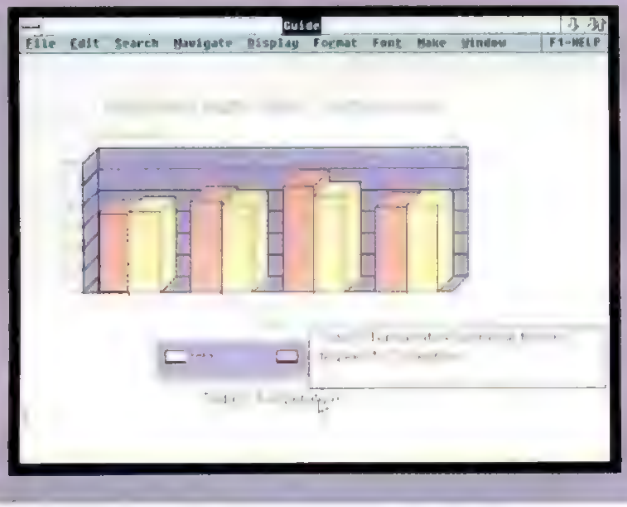
Even with only eight colors, *Guide* proved remarkably slow at painting graphics. Though simple graphics and text windows are drawn quickly, the transitions between the full-screen images in our test script were painfully labored. *Guide* does not support transition effects such as fades, wipes, dissolves, reveals, or explodes, nor can it continuously cycle through a program while awaiting keyboard input.

WEAK VIDEODISK SUPPORT

In theory, *Guide* supports any multimedia device for which a *Windows* driver exists, including videodisk players. But at the time of this testing, *Guide*'s support is not fully integrated with the core package. OWL International says it has plans to provide an easy-to-use interface for the VideoLogic DVA-4000 sometime this year. In the meantime, to control a videodisk player, you must write a short program in LOGiiX that sends and receives command strings to and from the serial port.

> Even with only eight colors, *Guide* proved remarkably slow at painting graphics.

Guide's most serious drawback for developing interactive multimedia presentations is its lack of support for on-screen animation. The flight of the airplane across the screen in our test presentation could only be achieved by shifting a window across the screen several pixels at a time using the LOGiiX programming language; a slow, unsatisfactory procedure.



Guide is short on animation and graphics effects but can do a good job of presenting simple graphic and text information, such as this weather graph.

FACT FILE

Guide
OWL International Inc., 2800 156th Ave. SE, Bellevue, WA 98007; (800) 344-9737, (206) 747-3203
List Price: $495.
Requires: IBM AT, PS/2, or compatibles, 640K RAM (1MB recommended), hard disk, EGA or VGA graphics adapter recommended, mouse, DOS 3.1 or higher, *Windows* 2.03 or higher.
In Short: *Guide* can be good for text-intensive applications with relatively simple graphic, audio, and video embellishments. But its inadequate support for animation, video, and high-resolution graphics makes it unsuited to interactive multimedia presentation.

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MULTIMEDIA AUTHORING SYSTEMS: SUMMARY OF FEATURES

Products listed in ascending price order

	Guide	Instant Replay Professional	Quest	IconAuthor	TIE
List price	$495	$595	$1,795	$2,495	$2,500
ENVIRONMENT					
Text-mode menus	❑	■	■	❑	❑
Graphical user interface	■	❑	■	■	■
INPUTS FROM EXTERNAL DEVICES					
Has interface for:					
Videodisc	■	■	■	■	■
Controllable VCR	■	■	■	■	❑
CD-ROM	❑	❑	■	■	❑
Audio cassette	■	■	❑	❑	❑
Video digitizer	❑	■	■	❑	❑
Synthesized audio board	❑	❑	■	❑	❑
Full-motion video board	■	■	■	■	■
TEXT AND GRAPHICS IMPORT					
Imports:					
ASCII	■	■	■	■	■
.PCX	■	■	❑	■	❑
Targa	❑	■	❑	❑	❑
TIFF	■	❑	❑	❑	❑
Windows Metafile	■	❑	❑	■	■
Paragraph formatting	■	■	❑	❑	❑
Screen capture	None	Editable	Locked	Editable	None
Maximum screen resolution and color	640 x 480 x 8*	640 x 480 x 16	640 x 480 x 256	640 x 480 x 8*	640 x 480 x 8*
PAINT AND DRAW FEATURES					
Freehand drawing tools	❑	■	■	■	■
Vector-based drawing capabilities	❑	❑	■	❑	■
Number of graphics primitives	None	5	8	12	8
Cut-and-paste portions of screens	■	■	■	■	■
Clip art included	■	❑	■	❑	❑
Palette editing	❑	■	■	■	■
ANIMATION FEATURES					
2-D animation	❑	■	■	■	❑
3-D animation	❑	❑	❑	■	❑
Canned animation	❑	■	■	❑	❑
Sprite animation	❑	■	■	■	❑
Cel animation	❑	■	■	■	■
Path animation	❑	■	■	■	❑
Accepts animations from external programs	■	■	■	❑	❑
Tweening	❑	❑	■	❑	❑
Transitional effects	❑	■	■	■	❑
Number of transitional effects	❑	22	36	12	N/A
Real time (seconds)	N/A	❑	■	❑	N/A
Machine time (slow/medium/fast)	N/A	■	❑	■	N/A
AUDIO SUPPORT					
Analog source input	■	■	■	■	■
Digital source input	■	■	■	■	■
Supports MIDI interface	❑	❑	❑	❑	❑
Supports digitized audio board	■	■	■	■	■
Edits digitized audio	❑	■	■	❑	❑
Synthesized sound	❑	■	■	❑	■
Treats laserdisk audio channels independently	■	■	■	■	■
VIDEO SUPPORT					
Full-screen motion video	■	■	■	■	■
Motion video in a window (board dependent)	■	■	■	■	❑
Videodisk search without screen blink	■	■	■	■	■
Controls multiple video inputs	■	❑	■	■	■

■—Yes ❑—No

N/A—Not applicable: the product does not have this feature.

*These products come with *Microsoft Windows* standard screen drivers.

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All in all, *Guide* is best suited to applications that organize text, and incorporate only simple graphics, audio, and video elements. If you're interested in a full-blown interactive multimedia presentation, *Guide* is not for you.

IconAuthor

by Alfred Poor

As a kid, I was fascinated by bridges. When I received an erector set, I was able to quickly create some simple bridges, but I was a little surprised to find out just how hard it was to build structures modeled after the real bridges I'd seen. In this sense, *IconAuthor* from AimTech Corp. is like an erector set for multimedia presentations: creating a simple presentation isn't too difficult, but a complex one requires a lot more work.

Priced at $1,095 for the base system, or $2,495 with all its modules included, *IconAuthor* runs under *Windows*—the source of some of the package's strengths and many of its weaknesses. One of its strengths is ease of use. Building a presentation is simply a matter of using icons as building blocks to create a flow chart. Each icon clearly represents its function; for instance, the Audio Track icon carries a picture of earphones, while the Image Display icon has a picture of a monitor. There are branching icons, too—a diamond-shaped "If" and a pair of "Loop" icons.

To create a presentation, you simply decide which functions you'll need, highlight the appropriate icons in the Icon Library window, and pull down menus or strike Alt-key combinations to copy the icons into your flowchart. You can then set the options and parameters for each function by double-clicking on the icon. For example, for an Animation icon, you'd enter information about the kind of animation to perform, which file to use, where to locate it, and what kind of video effects to apply.

GRAPHICS AND VIDEO

Though *IconAuthor* comes with a simple graphics editor for creating PCX files (its standard graphics file format), it won't let you edit a full screen in 256-color mode under *Windows*. As a result, I had to rely on PC Paintbrush IV Plus for my art editing tasks. According to AimTech, a new release planned for *Windows* 3.0 will solve this limitation by making its native graphics editor more capable.

IconAuthor also comes with an animation editor that is capable enough to let you develop quite complex animations—though it's a little difficult to use at first. Either by defining specific screen locations, or by tracing a path directly on the background image, you can successively manipulate multiple animated images relatively easily—though you can move only one object at any one time. You can easily define which color should be transparent for the animated image, so that it can be overlaid on graphics backgrounds.

IconAuthor's video editor lets you view videodisk images from any of ten videodisk players. Its player-control features are excellent: you can select a specific frame,

FACT FILE

IconAuthor
AimTech Corp., 77 Northeastern Blvd., Nashua, NH 03062; (800) 289-2884, (603) 883-0220
List Price: Base system, $1,095; Video Disk Module, $495; Overlay Module, $495; Digital Audio Module, $495; Animation Module, $295; full system with all modules, $2,495.
Requires: IBM AT, PS/2, or compatibles, 640K RAM, hard disk, EGA or VGA graphics adapter recommended, mouse, DOS 3.0 or higher, *Windows* 2.03 or higher.
In Short: While *IconAuthor*'s shortcomings won't endear it to professionals, its ease of use and solid features should meet the needs of many business users. Look for a *Windows* 3.0 release scheduled for later this year, however, which should solve many of the program's problems.

CIRCLE 417 ON READER SERVICE CARD

MULTIMEDIA AUTHORING SYSTEMS: SUMMARY OF FEATURES

	Guide	Instant Replay Professional	Quest	IconAuthor	TIE
END-USER CONTROL					
Enter word or phrase	■	■	■	■	■
Mouse	■	■	■	■	■
Graphics tablet	❑	■	■	■	■
Light pen	❑	■	■	■	❑
Touch-screen	■	■	■	■	■
Speech recognition	❑	❑	■	❑	■
TRAINING FEATURES					
Scores multiple responses	■	■	■	■	■
Intelligent scoring	❑	■	■	❑	■
PROGRAMMING FEATURES					
Macro recorder	❑	■	■	❑	❑
High-level script language	■	❑	■	■	■
Editing/debugging tools	■	■	■	■	■
Can link to external programming language	■	■	■	■	■
Creates link buttons	■	■	■	■	❑
Creates object-oriented link buttons	■	■	■	■	■
Can test presentation while authoring	■	■	■	■	❑
Compilable code	❑	■	❑	❑	■
Creates run-time or executable version	■	■	■	■	■

■—Yes ❑—No

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LOGITECH

CIRCLE 182 ON READER SERVICE CARD

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IconAuthor uses icons as the building blocks for your presentations. The Icon Library window shows all the available functions from which you can select. You then fill in specific information on each icon using dialog boxes.

IconAuthor's Video Disk module makes it easy to preview video sequences and incorporate them into your presentation. Freezing the screen displays the frame number. You can then play both forward and backward at many speeds.

play forward or backwards at different speeds, or even scan through the disk at very high speed. You can turn the sound on and off for each of the two audio tracks, and display the disk's frame index. *IconAuthor*'s video icons let you incorporate still frames, video segments, or simply play continuously. The system's major flaw is that the only key color it supports (the color to be transparent during overlays) is black. According to AimTech, new drivers are being developed that allow you the choice of which key color to make transparent.

SMART TEXT

One of the most useful editors in the package is the one that creates "Smart Text." This is text information to which you can assign foreground and background colors, in addition to the typical font, weight, and type size. A Smart Text file can contain multiple pages of text, each consisting of a single graphics screen that may only contain a small amount of text. This lets you change the content of text overlays without running *IconAuthor*—you simply edit the ASCII file in which the text is stored on your hard disk.

IconAuthor is also strong in its branching facilities. With them, you can create sophisticated scripts for menus, subroutine processing, and running external applications (which need not be *Windows* applications so long as you supply PIF files). You can define and use a wide range of variables, including arrays, and you can read from and write their values to disk files, which are stored in ASCII format. You can even create, read, and update *dBase*–formatted files.

NOT WITHOUT FLAWS

Though *IconAuthor* is relatively easy to set up and offers a variety of capabilities, it has a number of shortcomings. Luckily, most of the problems are of the nuisance variety rather than fatal flaws.

For instance, though you can define active "button" regions on graphic screens that can be activated by the mouse, cursor keys, or keyboard, it can be difficult to define these regions accurately, because you cannot always see the underlying image. *IconAuthor* was not able to display the 256-color PCX images in this editing mode, and I had to guess as to the exact locations of these regions.

The icon-based flowchart script is easy to read and understand, but it takes up a great deal of screen space. Our relatively simple test presentation took up four screens. You'll find yourself scrolling back and forth a lot as you edit your presentation, a tiresome chore. Fortunately, a "Find" function makes it easy to jump to a specific icon. For those who spend most of their time creating and editing presentation scripts, a command-based approach might be more efficient.

Correctly sequencing the icons themselves can be tricky, too. For example, there are many ways to clear a screen to reveal a video image, but I had to try numerous approaches with icons in different orders to reduce undesired split-second screen-blanking in transitions from graphics to video.

WINDOWS LIMITATIONS

IconAuthor's thorniest problems arise from *Windows*' memory limitations. Most notably, the application cannot restore the original *Windows* palette after the colors have been changed by a displayed graphic image. The test images reset the *Windows* screen colors to such strange combinations that it became impossible to see the *IconAuthor* script.

I got around this problem by creating a dummy image with a compatible color palette that I could use to reset the colors. But the problem also means you can't entirely predict what effect an image's colors will have on the display of another; for instance, when you overlay text on a graphic screen. Unfortunately, the only solution is trial and error. AimTech says that its *Windows* 3.0 version will solve this problem as well.

IconAuthor was among the easiest of these authoring systems to use, and it offers highly sophisticated script development features. But it still takes a significant amount of effort to master, and it is somewhat limited in terms of the final quality of its presentations. Most users will find it suitable for in-house and other less critical tasks, but professionals will find the shortcomings of the current version hard to accept.

Instant Replay Professional

by Tom Unger

If a single phrase is needed to sum up Nostradamus's *Instant Replay Professional*, it would be "everything but the kitchen sink." Costing $595 for the software alone, or $2,590 for the software and the IEV VIP-8800 motion video board it supports, *Instant Replay* has more features for building interactive multimedia presentations, tutorials, and demonstrations than you may ever need. If you're considering this product, be aware that with this much power comes a corresponding degree of complexity.

Instant Replay currently supports only IEV's VIP-8800 motion video board, although Nostradamus says it has drivers for other boards in the works. The software Nostradamus initially sent to PC Labs was configured for the older IEV VIP-8000 and would not work with the newer board. To its credit, Nostradamus' able technical staff solved the problem immediately by sending us a new driver, after which installation and configuration was mercifully simple and brief.

FOUR-WAY STREET

Instant Replay offers four methods for creating presentations—each different in its approach, options, and capabilities. External Program Replay lets you create demos and tutorials by memorizing live sessions inside other applications such as a word processor or a spreadsheet program. Graphics Animation makes use of *Instant Replay*'s Mystro screen editor to record and manipulate graphics, text, and external video sources. Text Animations lets you use *Instant Replay*'s text screen editor, Screen Genie, to memorize text-based presentations. Finally, the Slideshow Maker lets you create self-running, interactive computer-based slideshows. Each method

MULTIMEDIA BY VIDEODISK: Motion Video Boards for the PC

by Lori Grunin

Motion video overlay boards have been around for years, steadily giving quiet service as part of turnkey training systems in such unglamorous locales as classrooms and shop floors. Now multimedia applications that demand the integration of video with PC graphics have thrust them into the spotlight.

This type of adapter is necessary if you want to display NTSC output from a videodisk player or other video device on a standard VGA monitor. NTSC signals are interlaced, which means that they combine two video *fields* (one containing the odd scan lines, the other the even scan lines) to form each video *frame*; the scan rate is 30 frames per second. To convert this signal to the noninterlaced, 60-frame-per-second VGA signal, the motion video board separates the composite NTSC signal into its red, green, and blue components. Then it combines the first and second fields, displays the frame, combines the second and third fields, displays the frame, and so on. This is the same technology used by improved-definition television (IDTV).

Motion video overlay boards also come with genlocking circuitry, which lets you superimpose PC-generated graphics or text on the video images. To do this, you specify which color you would like to be transparent; video shows through wherever this so-called *key color* appears in the graphic image.

Note that these motion video boards do not actually control videodisk players; instead, they respond to commands sent through the PC serial port.

A NEW GENERATION

The low profile of the earliest motion video boards, such as Sony's SMI-3081, can be attributed in part to their limited capabilities. These cards restrict video the full screen; while you can create an on-screen window by judicious use of graphics and key color, you can't shrink the entire video frame to fit in the window. Furthermore, you're usually limited to one key color, and control over video output extends solely to telling the player which frames to display, as well as how fast and in what direction to play them.

The latest generation of motion video boards offers much more dramatic capabilities. Currently, three products fall into this group: VideoLogic's DVA-4000, New Media Graphics' VideoWindows, and IBM's M-Motion Video Adapter/A. With any of these boards, you can place multiple video windows anywhere on the computer screen, displaying any desired region of the video frame or shrinking the entire frame to fit.

The boards also let you perform special effects such as inverting, copying, and dissolving video into graphics. You can use multiple key colors (out of a palette of 256 colors), control the degree of transparency of both the computer graphics and the video elements, and vary the hue, saturation, and brightness of the underlying video image. You can even digitize still video images, eliminating the need for a separate image capture board.

In addition to the video capabilities shared by all the boards, the M-Motion Video Adapter/A also has on-board audio digitizing and playback capabilities. The other two boards merely allow you to control the volume and channel of the audio coming from the videodisk player.

Of course, increased complexity accompanies this increased sophistication. For the earlier boards, the manufacturer could get away with supplying a few videodisk player drivers, a software utility, and some basic commands. The new boards come with full-blown application programming interfaces (APIs) that can be accessed through C function calls. While the boards are far from identical in their internal design, their functions are more or less equivalent—it's the API that truly differentiates them from one other.

IT'S ALL IN THE PROGRAMMING

Of the three, VideoLogic's DVA-4000 is most suited to the current installed base of ISA-bus PCs running DOS (see First Looks, *PC Magazine*, February 27, 1990, page 33). The DVA-4000 comes in both MCA- and ISA-bus versions and supports the widest range of videodisk players. It's also compatible with IBM's *InfoWindow*, Sony's *View*,

comes with a distribution compiler that lets you create royalty-free run-time versions of your presentations.

SUPERB FLEXIBILITY

Since our test script involved animation and videodisk clips, we used the Graphics Animation method, which combines most of *Instant Replay*'s powerful authoring and editing tools.

Although *Instant Replay* is a text-mode application, it makes use of Alt- and Ctrl-key combinations to pull down point-and-shoot or key-selectable mouse menus. These menus form the core of *Instant Replay*'s command structure. Here, you pull in PCX-format graphics files, create text overlays, and call for video images from the videodisk player.

Once you enter the Mystro screen editor, your every step—and misstep—is recorded to a file. Mystro also records the amount of time between each command or action. Fortunately, you can place a default cap on pauses between actions, and you can edit or remove those pauses or extra steps after you're through creating your animated sequence.

Instant Replay can directly import only PCX files, but it does come with a screen-capture program to grab and convert graphics files in other formats. Unfortunately, 256-color PCX images aren't supported within the Graphics Animation method, only in the Slideshow Maker. You can set up calling links from one method to another and thereby bypass this limitation, but this is an awkward course, and one that limits your options.

The Mystro screen editor is superbly flexible. It offers 22 separate transitional effects, ranging from standard wipes and fades to downright dangerous-sounding "color explodes," with ten levels of speed control for each effect. You have full palette control, and smaller graphical images can be pulled in as "touchdown" images to create complex 16-color animations.

When our test script called for an object to move completely across a full-screen logo, it was a simple process to edit the object out of a larger screen with the Mystro graphics editor, load the image—in this case a small airplane silhouette—on top of the logo, and then animate it with the mouse or arrow keys. *Instant Replay* was also the only package that could seamlessly wipe a graphic screen to reveal video playing underneath.

INSERT MENU

You can enhance your presentations with *Instant Replay*'s Insert Guide, a pop-up menu that lets you insert various functions into your replays, including pop-up text boxes, data variables and arrays, logical branching, and requests for sound and video. Each of these "inserts" is memorized just like your other keystrokes and mouse commands, and each forms a module inside the larger presentation, which simpli-

and *Matrox* applications, as well as those written for VideoLogic's own IVA series of motion video boards. Because its Multimedia Interactive Control (MIC) system API works by setting up a DOS input/output device, the DVA-4000 works with almost any language or environment. Programs can address the Videologic board much like they address an ordinary serial or parallel port.

In contrast, VideoWindows and the M-Motion Video Adapter/A are targeted more at future environments. While the VideoWindows board works in ISA-bus machines and its basic API commands can be called by any C program, it is truly best adapted for use with *Microsoft Windows* or *HP NewWave* dynamic link libraries (DLLs). And while the Micro Channel-only M-Motion Video Adapter/A (which we were unable to obtain by review time) works under DOS, the Multimedia Developers Kit that supports it is a library of C functions primarily geared to producing OS/2 Presentation Manager DLLs, though they can be incorporated into ordinary C programs as well.

Because of their superior capabilities and advanced interfaces, these new motion video boards offer highly practical ways to bring motion video into multimedia applications as soon as applications support them more widely. They let you duplicate many of the effects of digital video, using proven, cost-effective videodisk technology. ■

M-Motion Video Adapter/A
IBM Corp.; contact your nearest authorized IBM dealer: (800) IBM-2468.
List Price: $2,250; M-Control program, $150. **Requires:** MCA-bus system (IBM PS/2 Model 50 and higher) with free video slot, compatible videodisk player, DOS 3.3 or later, OS/2 PM standard and extended editions, versions 1.2 or later, VGA or Super-VGA video monitor.
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VideoWindows
New Media Graphics Corp., 780 Boston Rd., Billerica, MA 01821; (508) 663-0666.
List Price: VideoWindows base package, $2,195; VideoWindows MS (Windows driver), $195; VideoWindows NW (New Wave driver), $295; VGA loop cable, $30. **Requires:** ISA-bus PC, DOS 3.2 or later, VGA adapter with feature connector. VideoWindows MS: same as above plus *Microsoft Windows* 2.11 or later. VideoWindows NW: same plus *HP NewWave End User* 1.0 or later.
CIRCLE 414 ON READER SERVICE CARD

VideoLogic DVA-4000
VideoLogic Inc., 245 First St., Cambridge, MA 02142; (617) 494-0530.
List Price: DVA-4000/ISA, $2,495; DVA-4000/MCA, $2,495; MIC system software, $150; Toolbox Plus, Monitor, and Mask development tools, $195 or all three for $495. **Requires:** VGA board with feature connector for ISA version (512K VRAM recommended), DOS 3.1 or later.
CIRCLE 415 ON READER SERVICE CARD

FACT FILE

Instant Replay Professional
Nostradamus Inc., 4525 South Wasatch Blvd., #335, Salt Lake City, UT 84124; (800) 388-8086, (801) 272-0671
List Price: $595 (software only); IEV VIP-8800 motion video board, $1,995; audio board and sound editor, $300; complete system with both, $2,500.
Requires: IBM XT, AT, PS/2, or compatibles; 512K RAM; hard disk, mouse; CGA, EGA, or VGA graphics adapter, DOS 2.0 or higher
In Short: This complex program's overlapping modules make it difficult to learn, but once you've mastered its convoluted structure and many features, it's capable of excellent results.

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Use Microsoft® Excel and Microsoft Word for Windows™ and you'll no longer be saddled with the problem of combining words, numbers and graphics. You see, they were designed to work together. Which means they share a good deal more than a name.

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ow spreadsheets rs worked together.

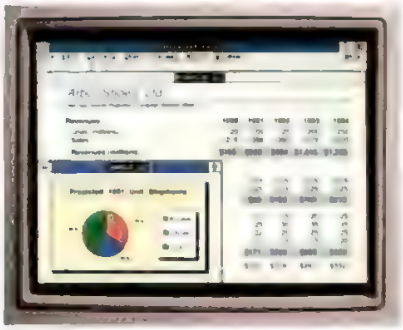
What's more, these products are based on the Microsoft Windows environment, an approach that's not only inherently easy to use, but rapidly becoming the industry standard.

It is this environment that allows for complete and total WYSIWYG. Or, *what you see is what you get.* Translated that means the image on-screen looks precisely like the final document.

Something that will save you more than a few trips to the printer.

Beyond sharing the same overall physical appearance, these applications also share similar commands. So when you've mastered one, you'll have a solid understanding of the other as well.

With Microsoft Excel and Word, you can make a change in a spreadsheet and automatically update any Word documents you've linked. Or vice versa.



And surprisingly, using Microsoft Excel and Word together requires very little brain power. All you need is a 286/386 computer with 2 megabytes of random access memory. Also known as RAM.

For more information on how smoothly these products work together, call (800) 541-1261 Dept. L5.

Before you get roped into buying the wrong product.

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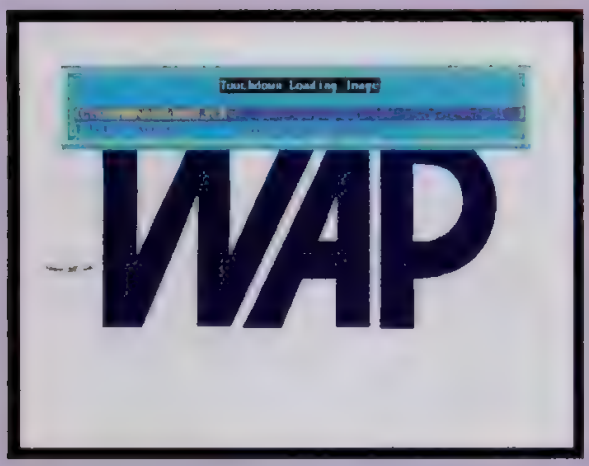

Instant Replay has excellent animation features. Its Touchdown Effects Menu lets you pull in an image smaller than full-screen that animated over a full-screen graphic.

Instant Replay Professional's Insert Guide offers a wide variety of options for controlling sound and still or motion video from videodisk. It uses text menus.

fies the job of editing and correcting the final product.

You use an insert to choose the transparent video key color and to set your video playback parameters. The video player control menu is full-featured, letting you play the disk at slow, normal, fast, or fast-scan speeds (both forward and in reverse) to freeze-frame, and to mark segments for playing in your presentation.

To help you edit out the mistakes in your presentation, *Instant Replay*'s Replay Editor shows the elements of your presentation file in time-line fashion. Here, you can edit each of the links, commands, and

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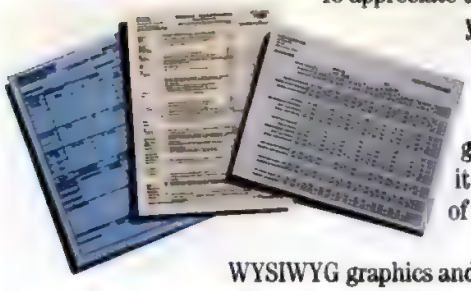
WE'D LIKE TO SUGGEST A FEW NEW CRITERIA FOR CHOOSING FORMS SOFTWARE.



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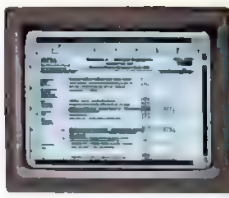

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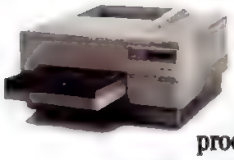

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actions individually, and add or remove inserts and branching menus. You can selectively replay any part of your presentation and call up a pop-up editor to edit any specific element.

The Replay Editor takes some getting used to, since it shows your presentation as a series of commands instead of as a series of moving images. Nevertheless, learning to use it is much like learning to use a simple word processor—once you remember the various commands, editing is a whiz.

CLIP ANIMATIONS

To create an entire presentation in one fell swoop would be nearly impossible. Fortunately, *Instant Replay* lets you create "clip animations," each one a small piece of a multimedia presentation that can be edited and played separately before being fully integrated into the larger whole.

For example, in our test presentation, the initial file contained a looping "attract" screen that endlessly invited a viewer to enter a keystroke and start the interactive presentation. We created the routines that asked for the user's input, plus the branching menus, video segments, graphics animations, and text pop-ups as individual clip animations, then inserted them one by one into the main file.

A bug prevents you from simply linking completely separate mini-presentations together. If you memorize each piece separately, the Esc keystroke that exits from the Mystro screen editor is, naturally, recorded at the end of the replay file. This keystroke erases the contents of the file from which the piece is called, making it impossible to run any presentation linked in this way more than once. A call to Nostradamus and a quick deletion of the Esc keystrokes worked around the problem. Nostradamus claims a fix is in the works.

TOO MUCH OF A GOOD THING?

Perhaps *Instant Replay*'s only true defect is that its modular approach requires too much shifting from one mode to another—from memorization to editing to screen capture and back to memorization, and so on. Nevertheless, after a few days with the software, we found it quite easy to jump from mode to mode, and didn't find its modularity a barrier to creativity.

If the highly professional quality of an *Instant Replay* production is any indication of its effectiveness, you may well find it worth the struggle to learn it. If you can't afford to pay for a production studio, *Instant Replay* may be the next best thing.

Quest

by Robin Raskin

Quest is designed for authoring computer-based training courses, and it's most at home tracking a classroom of students. But while this $1,795 package can certainly create a handsome presentation, the complexity of the educator's paradigm on which it's built and the overhead of its student-based management facilities make *Quest* unnecessarily bulky for the business presenter.

After you log in (and you must log in), *Quest*'s system shell provides easy access to all of its components, namely, The Authoring System, Take a Course, and Computer Managed Instruction Tools to register and track users, plus assorted editors and utilities. The program's manuals are not especially dense, although more step-by-step lessons and some contrasts in terminology—how an "event" differs from a "performance," for example—would make things easier to learn.

Quest has two levels of authoring: an interactive program called Author which uses dialog boxes and prompts, and QAL, a programming language similar to Pascal. The interactive menus can do most everything QAL can do, but the latter handles complex animations and simulations with greater fluidity.

Author divvies the components of a presentation into "lessons," "frames," and "objects." In lessons you define basic parameters: fonts, hardware setup, graphics modes and student management. Frames are the building blocks of each lesson, and these, in turn, are made of objects: graphic primitives, captured images, branching statements, video segments, or animation. Those used to thinking of frames as static entities will take a while to get accustomed to *Quest*'s frames, which can hold numerous events and objects.

There are many impediments to working with objects. All the moves you make—including missteps—become part of the object list. You can edit a list by deleting or copying an object, but because objects have cryptic names like BMAP (bitmap images) CIMG (cut images) and AA (performance) it's hard to tell which name corresponds to which object on the list.

Moreover, you can't directly reorder objects within the list; instead, you must memorize the ordered list, head back to the dialog boxes, and use the arrow keys to scan the confused list notation manually. Once you've inserted an object, all the other object numbers change. To do multiple changes, you've got to be able to keep track of list positions or you'll have to repeat the convoluted process. *Quest* sorely needs an interactive text editor that would let you work directly on the object list.

> *Instant Replay*'s Replay Editor shows your presentation as a series of commands instead of as a series of moving images.

AUTHORING TOOLS

These criticisms aside, *Quest*'s full and complete spectrum of authoring tools help you to produce complex training material. Its Text Filter lets you import ASCII text, to which you can add menu-selectable attributes such as underlining, centering, and fonts. Eight fonts are built into the sys-

FACT FILE

Quest
Allen Communication Inc., 140 Lakeside Plaza II, 5225 Wiley Post Way, Salt Lake City, UT 84116; (800) 325-7850, (801) 537-7800
List Price: $1,795.
Requires: IBM XT, AT, or compatibles; 640K RAM; hard disk; MCGA, EGA or VGA graphics adapter; DOS 2.11 or higher.
In Short: Designed primarily for computer-based training, *Quest*'s potpourri of authoring tools make it useful for creating interactive presentations as well. But its educational design slant gets in the way of clear understanding, and it stumbles on VGA-resolution animation.

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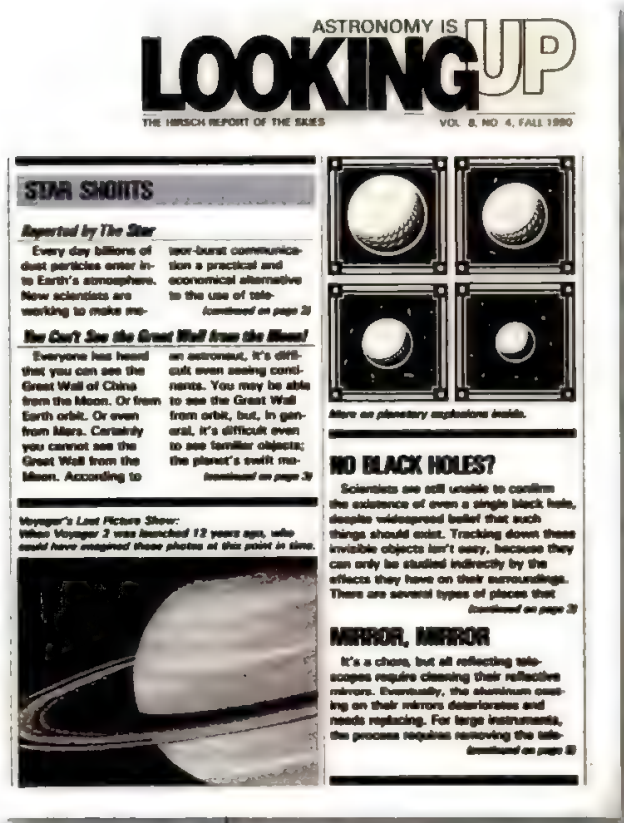
Other laser printers play with one standard dot size.

HP makes it a



ASTRONOMY IS LOOKING UP

THE HIRSCH REPORT OF THE SKIES

VOL. 8, NO. 4, FALL 1990

STAR SHORTS

Reported by The Star

Every day billions of dust particles enter into Earth's atmosphere. New scientists are working to make me-

laser-burst communication a practical and economical alternative to the use of tele-

(continued on page 3)

You Can't See the Great Wall from the Moon!

Everyone has heard that you can see the Great Wall of China from the Moon. Or from Earth orbit. Or even from Mars. Certainly you cannot see the Great Wall from the Moon. According to an astronaut, it's difficult even seeing continents. You may be able to see the Great Wall from orbit, but, in general, it's difficult even to see familiar objects; the planet's swift ma-

(continued on page 3)

Voyager's Last Picture Show:
When Voyager 2 was launched 12 years ago, who could have imagined these photos at this point in time.

More on planetary explorers inside.

NO BLACK HOLES?

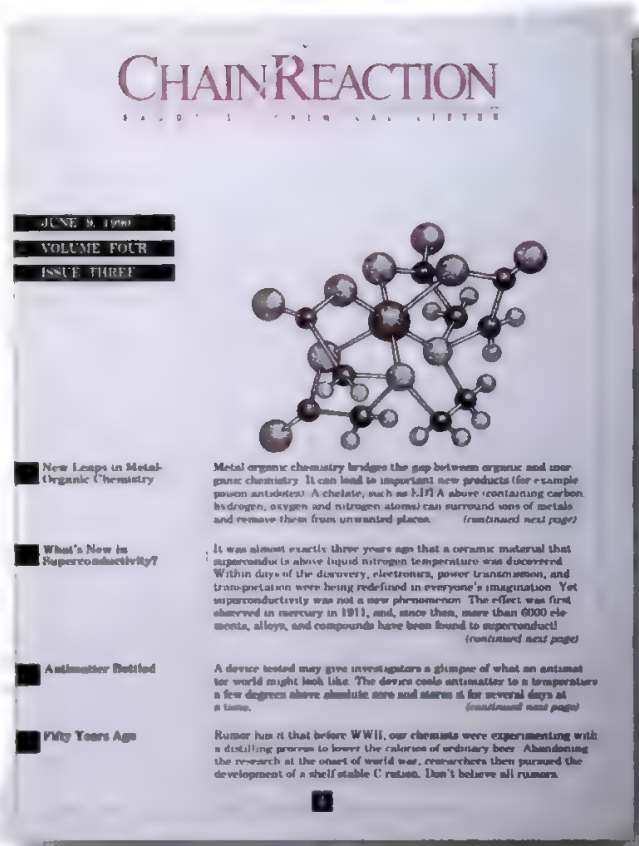
Scientists are still unable to confirm the existence of even a single black hole, despite widespread belief that such things should exist. Tracking down these invisible objects isn't easy, because they can only be studied indirectly by the effects they have on their surroundings. There are several types of places that

(continued on page 3)

MIRROR, MIRROR

It's a chore, but all reflecting telescopes require cleaning their reflective mirrors. Eventually, the aluminum coating on their mirrors deteriorates and needs replacing. For large instruments, the process requires removing the tele-

(continued on page 3)



CHAIN REACTION

JUNE 9, 1990
VOLUME FOUR
ISSUE THREE

New Leaps in Metal-Organic Chemistry

Metal organic chemistry bridges the gap between organic and inorganic chemistry. It can lead to important new products (for example poison antidotes). A chelate, such as EDTA above (containing carbon, hydrogen, oxygen and nitrogen atoms) can surround ions of metals and remove them from unwanted places. *(continued next page)*

What's New in Superconductivity?

It was almost exactly three years ago that a ceramic material that superconducts above liquid nitrogen temperature was discovered. Within days of the discovery, electronics, power transmission, and transportation were being redefined in everyone's imagination. Yet superconductivity was not a new phenomenon. The effect was first observed in mercury in 1911, and, since then, more than 6000 elements, alloys, and compounds have been found to superconduct! *(continued next page)*

Antimatter Bottled

A device tested may give investigators a glimpse of what an antimatter world might look like. The device cools antimatter to a temperature a few degrees above absolute zero and stores it for several days at a time. *(continued next page)*

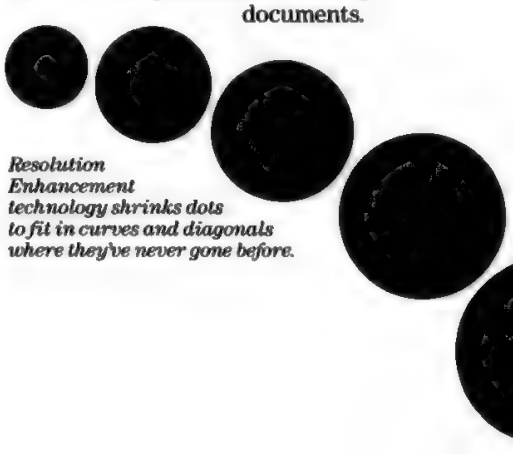
Fifty Years Ago

Rumor has it that before WWII, our chemists were experimenting with a distilling process to lower the calories of ordinary beer. Abandoning the research at the onset of world war, researchers then pursued the development of a shelf stable C ration. Don't believe all rumors.

Introducing the new HP LaserJet III printer with Resolution Enhancement technology.

The rules have changed. Now the name of the game is Resolution Enhancement technology. You'll call it the best thing to happen to laser printing since the very first HP LaserJet printer. It gives you clearer resolution. Curves that really curve. And edges that are never jagged.

Instead of a "one-size-fits-all" dot, HP's built-in intelligence varies dot sizes. So they can fill areas where they could never go before. For clearer, more professional-looking documents.



Resolution Enhancement technology shrinks dots to fit in curves and diagonals where they've never gone before.

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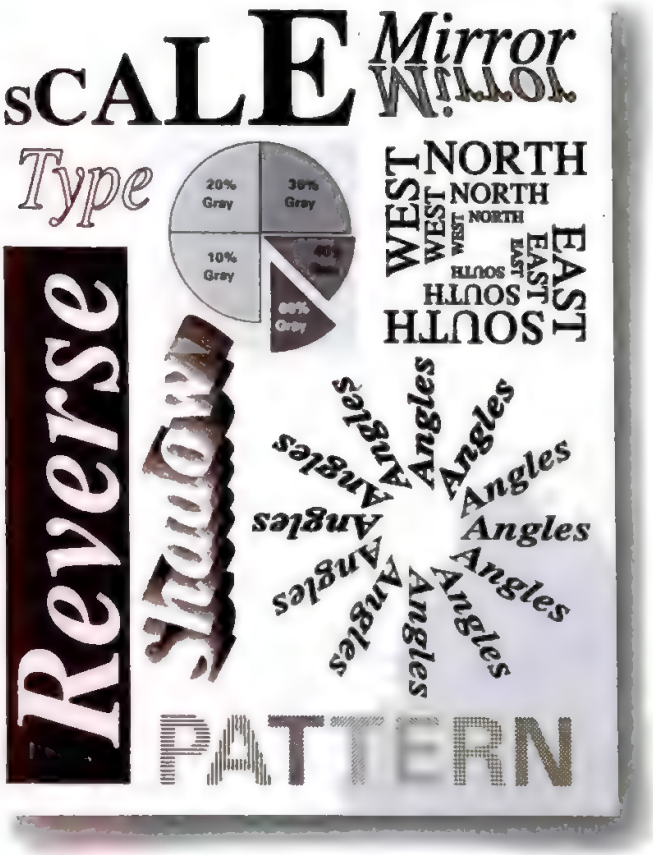
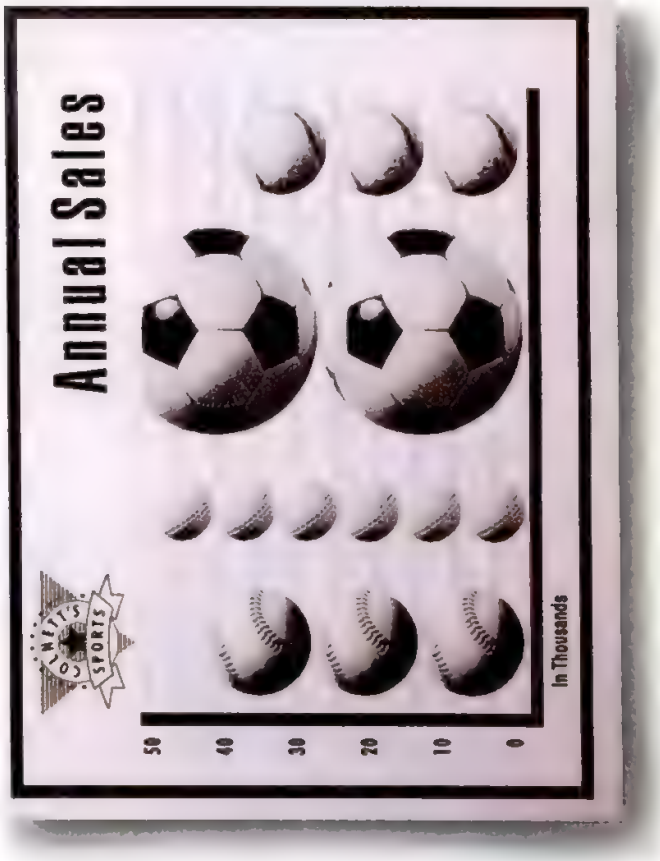
whole new ball game.





But there's more than better print quality. 14 bit-mapped fonts and 8 internal scalable typefaces provide thousands of options. And enhancements to our PCL5 printer language, including our HP-GL/2 graphics language, let you print portrait and landscape on the same page. Reverse and angled type. Spirals. Even shaded text. You can also plug in Adobe PostScript® software.

For all its new features, the $2,395* list price of the HP LaserJet III is a good deal less than the HP LaserJet

Series II printer it replaces. With the same hardware compatibility, wide range of applications, 8 ppm print speed, and software compatibility, including WordPerfect 5.1 and WordStar® 6.0. And the same reliability as the rest of the HP printer family.

So call **1-800-752-0900, Ext. 1007.** Ask for our booklet on Resolution Enhancement technology and where to find your nearest authorized HP dealer. We'll put you in a whole new league.

There is a better way.

HEWLETT PACKARD

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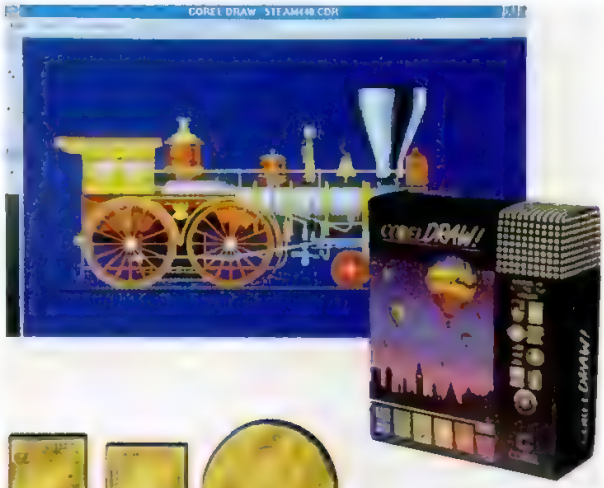

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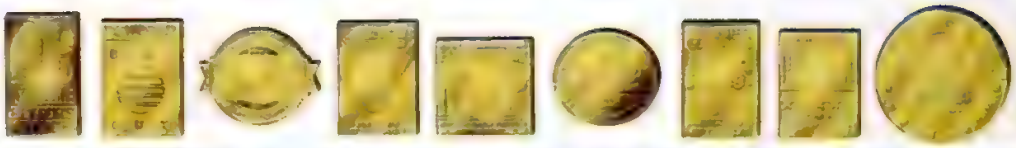

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tem, but these don't include any large sizes over 40-point, and the bitmapped fonts are disappointingly spindly. Many more fonts are available from the vendor at extra cost, though, and a character generator included with the program lets you build or modify them.

Drawing capabilities are limited to graphic primitives and spline curves, sufficient for creating simple diagrams. You can rotate, flip, angle, fill and scale, and even group your shapes, but you'll probably want to use other software for the bulk of your graphics. You cannot directly import graphics files in other than *Quest*'s native file format, but a memory-resident screen-capture utility lets you bring in images from other programs. It's powerful enough to handle even high-resolution Targa screens and digitized photos without a problem.

Quest's graphics animation is robust, but not in the VGA environment. If you have an EGA graphics system, you can superimpose animations even on complex backgrounds, but in VGA you are limited to path (point to point) animation without superimposition. Animated VGA objects must be placed on a black background or the video screen goes haywire.

Worse still are the problems you'll have using transitional effects with VGA images. Effects such as fades or pull-downs throw the VGA screen out of whack. Unless you employ EGA, you cannot use any of the 30 different built-in transitional elements; you're limited to the default Draw transition. Despite the dearth of VGA support for animations and transitions, I had no problem overlaying a 640-by-480-pixel, 256-color text bitmap atop a videodisk image and the program's color mixing capabilities are excellent, with a full palette of 16.7 million colors. You can even define gradient color fills.

Branching and judging are where *Quest* really shines. Even the most complicated branching sequences can be created using well-designed dialog boxes.

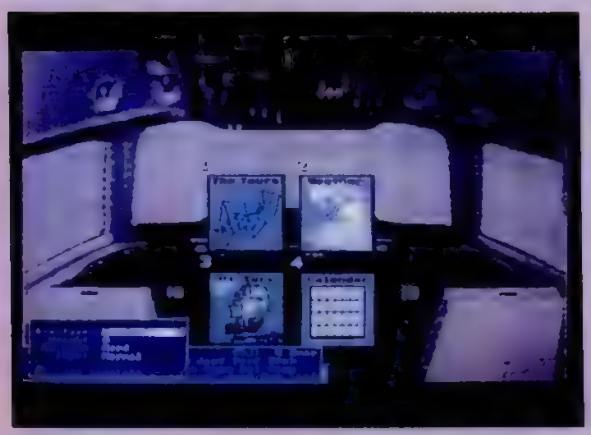
To facilitate working with recurring images, shapes, and clips, you can create a storage library for each image type. Yet the distinction between the three libraries is fuzzy, and there are some confounding limitations. For example, shapes are restricted in size and numbered instead of named. So, to recall a shape from the library you have to ask to retrieve "Library 1 Image One."

Quest supports a variety of videodisk players and has well-behaved interactive commands for finding a frame, setting the transparency, playing the video, and switching between audio tracks. Support for motion video boards was recently added to the program, although you will need to rely on the board's software (via *Quest*'s external program call) to manage on-screen windows and special effects. The program supports three PC sound boards and even has a built-in musical composition program.

SUPERIOR BRANCH

Branching and judging are where *Quest* really shines. Even the most complicated branching sequences can be created using the well-designed dialog boxes beneath the Performance selection on the menu. You can specify multiple events, and whether they should be tied to keystrokes, answers, timed events, positioned areas on the screen, or even video frames. You can specify correct or incorrect answers with weighting (a multiple-choice maker's nirvana), and you can even build in hints and tolerance for misspellings.

You can test your authored presentations without leaving the environment, but it's not until you "Take A Course" that you'll bump into the undetected logic mistakes in your presentation. Happily, you'll find it easy to edit out your errors. Useful utilities for searching and replacing words in a frame, creating macros, and printing



Quest displayed this 256-color cockpit menu with aplomb, but inserting the branching criteria is complicated by *Quest*'s education metaphor: to go to each item, you need to specify that the keypresses represent "Neutral" answers.

Quest comes with a unique music composer that turns your keyboard into a simple musical instrument. It does an nice job of supplying simple musical effects without requiring any additional audio hardware.

flowcharts can also prove helpful.

Quest is powerful, not too difficult to master, and contains all the tools necessary to create interactive presentations. However, its heavy slant towards educational courseware makes it a bit difficult to adapt to typical marketing presentations. Unless your work is training-based, you may want to keep searching.

TIE (Training Icon Environment)

by Luisa Simone

As Sesame Street demonstrates, only a thin line separates education and entertainment. So it's no surprise that computer-based training programs like *Training Icon Environment* ($2,500 from Global Information Systems) are pursuing the multimedia presentation market.

Make no mistake about it: *TIE*'s most powerful functions still revolve around judging and correcting student responses. But with a few compromises—like the forfeiture of screen wipes and dissolves—this *Windows*-based program proved itself capable of recreating the PC Labs test presentation.

TIE's authoring functions are accessed through 30-odd icons. Strangely, these are not listed on the main menu. Instead you must begin the flowchart that will represent your lesson or presentation by inserting the most basic of *TIE*'s symbols: a Unit. Units are purely organizational devices in which you can group related activities. Think of them as the headings in an outline.

Double click on a Unit, and a secondary window pops up, where you can insert specific icons to issue instructions or accept responses. The icons work with standard *Windows* conventions—dialog boxes with radio buttons and text boxes—so much of their function is self-explanatory. This makes it possible to compose straightforward presentations almost immediately. For example, to control a videodisk player, such as the Sony LPD-1550 we used, you simply add a series of Video Disk icons and then use the dialogue boxes to initialize the player, turn on the video, select the audio channel, and play a specified segment.

POWERFUL ICONS

Building logical—rather than sequential—links between Units, and creating an interactive sequence requires that you learn about *TIE*'s more powerful and complex icons. The Arrow Structure icon, for example, lets you specify all aspects of a student's or viewer's typed response or presentation. Icons nested within the Arrow Structure allow you to determine the location of the response and to judge the validity of the user's entry.

In PC Labs' test presentation, we employed the Menu, Loop Block, and Conditional Jump icons, respectively, to create the necessary branching structures, loops, and if/then statements. For instance, I was able to insert if/then stations into the flowchart by combining the Key Input/Timed Pause icon with several Conditional Jump icons. *TIE* gets high marks for flexibility, because I could have accomplished exactly the same result by using either the Menu or the Case Structure icon.

Once you've created these elaborate relationships, you can convert groups of related icons to modules that can be copied

FACT FILE

TIE (Training Icon Environment)
Global Information Systems Technology Inc., 1800 Woodfield Dr., Savoy, IL 61874; (800) 327-0565, (217) 352-1165
List Price: $2,500 (includes demo/run-time version). Unix version, $2,200.
Requires: IBM AT, PS/2, or compatibles, 640K RAM (expanded memory recommended), hard disk, EGA or VGA graphics adapter recommended, mouse recommended, DOS 3.0 or higher, *Windows* 2.03 or higher.
In Short: This training-oriented system is flexible enough to create good-looking interactive presentations, though you'll have to dispense with transition effects. But file import, memory management, and compiler problems make the end harder to achieve than it should be, especially at this expense.

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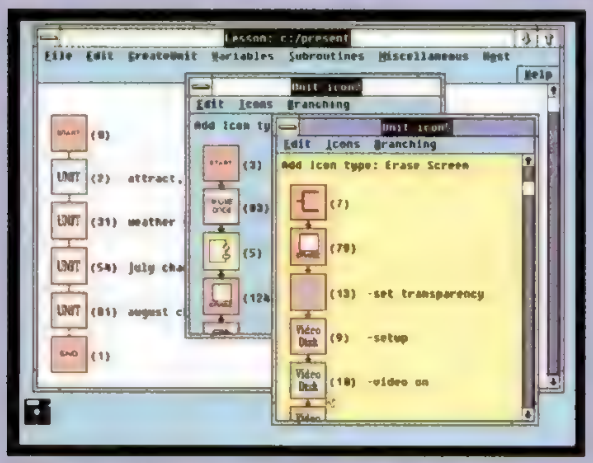

TIE helps you keep your place by coding the background color of the window to the color of its associated icon. For instance, the yellow, topmost window details the videodisk instructions nested within the yellow Loop Block icon.

TIE lets you "bring along" graphics images for reference when positioning text. The red box and red rules were created with a Graphics Code icon.

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(Panasonic)
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(Quarterdeck Office Systems)
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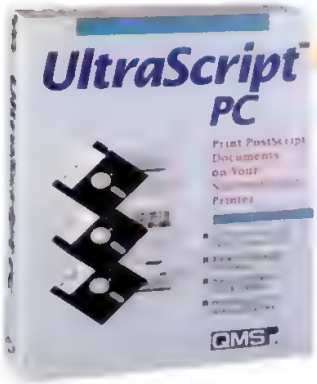

UltraScript PC 2.1

(QMS) Add PostScript capabilities to the printer you already own. UltraScript PC will allow you to print PostScript output from within your application, no need to print your file to disk and exit the program. Packed with 25 typefaces, this program gives you speed, quality and plenty of fonts at thousands less than a PostScript-compatible laser printer or add-on board. One of PC Magazine's Best of 1989. **$119.**

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CorelDRAW! 1.2

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or moved within or between Units. Alternatively, you can convert them to subroutines, which can be called from anywhere within a presentation using a special icon. This lets you reuse the elements from prior presentations, and cuts down on duplicate functions.

You can keep track of a complex flowchart by expanding the labels that appear next to each icon. This one-line text string can contain valuable descriptive information. Better yet, by generating a print file you can produce a bare bones ASCII outline clearly showing the hierarchical relationship (though not the logical relationships) between elements.

MEMORY PROBLEMS

Creating complex structures, creating modules, or simply copying icons from one Unit to another requires that you have a large number of working windows open simultaneously. It is not unusual to have five windows layered on-screen before you get to the pertinent dialog box. Though *TIE* attempts to clue you in to which windows relate to which icons by a using a logical color coding scheme, the screen can get very cluttered.

Worse, as more windows are opened and closed, performance suffers. *TIE* manages memory poorly. So even when you close the various windows, *TIE* leaves remnants of screen code stacked in memory. Sooner than you'd expect, and just when you are attempting a memory-intensive operation, error messages pop up.

This situation is most detrimental when it comes to importing graphics files. All files, be they ASCII text, VGA bitmaps, or *Windows* Metafiles, must be imported into *TIE* through cutting and pasting from the *Windows* Clipboard. I successfully copied the test text file from the *Windows* Notepad and pasted it into the *TIE* text editor, and the same process should have worked with our PCX-format graphics

EVALUATING MULTIMEDIA

by Lee R. Mandell and Pamela J. Livingston

In developing our testing script for the multimedia authoring systems, PC Labs found itself face to face with the same problems that confront business users trying to implement this complex technology. The process of designing a presentation and working through the plethora of hardware options required numerous choices before a single authoring system could be installed.

Our premise called for an interactive multimedia presentation of the kind that might be presented at a point-of-information kiosk in a travel agency. Accordingly, we conceived a sketch for a presentation on behalf of fictional WAP Airlines, promoting a new route to the Falkland Islands. This, we felt, would test most of the important functions multimedia applications would require, as it would marshall text, graphics images, scanned photographs, animation, sound, and full-motion video to the job of convincing potential travelers to find out about the fun awaiting them in the Falklands.

So, we had a plan. Next, we needed hardware. For the authoring workstations, we used Compaq 386 machines (two 25 MHz and one 16 MHz), equipped with large hard disks and multiscanning monitors (two Sony CPD-1302 and one NEC MultiSync 3D). This is the about the minimum practical level of computer power. Each authoring station was equipped with a Sony SMI-3081 motion video overlay board, a typical first-generation product that is widely supported among authoring systems; by and large, the newer boards such as the VideoLogic DVA-4000 still await the development of appropriate drivers. Three controllable videodisk players (two Sony 1550 and a Sony 1200) and assorted cables rounded out the setup.

Right away, we discovered that most of the work lies up front, in the planning and storyboarding phase. Our outline became a proposal, our proposal a flowchart, and the flowchart a storyboard. Though it may be tempting to skip or shorten this procedure, don't do it: you'll need a clear idea of your goal before you start wrestling with the authoring software.

To give the file-import capabilities a workout, we developed a range of graphics files for the menus, backgrounds, scanned photographs, and other still elements of the presentation. We used ZSoft's *PC Paintbrush IV Plus* to create or clean up the images. We generated both 16-color and 256-color .PCX files for importing into the authoring systems to test the ability of these systems to overlay high-resolution graphics on video. Some of the images were originally in the form of Targa files; we used Videotex's T-EGA to convert them down to .PCX format.

Our presentation begins with an attract loop, a sequence repeated until the customer presses a key to begin. It consists of the WAP logo with a small animated plane, followed by a push frame to a video of a plane taking off with "Flee to the Falklands" superimposed. This allowed us to test a product's animation and video overlay support, as well as its keyboard control and graphics import facilities.

After pressing a key, the customer is asked to enter his or her name; then the main menu—a scanned image of an airplane cockpit with icons representing the information choices—appears. Five icons are included (The Tours, Weather, History, Calendar, and Your Opinion), but, in the interests of time, only the Weather feature was fully implemented. The various choices give a full workout to the authoring systems' branching support.

The Weather option shows a weather video, complete with audio, from another section of the laserdisk, and then lets you select information about each of the Falklands winter months (June, July, and August). The information for each month included a chart, generated in *Harvard Graphics* and converted to a .PCX file) with overlayed graphics and text. A final screen displays comparative information on "Today's Weather" for both New York City and the Falklands.

The results? Well, you'll have to turn to the reviews to find that out. Rest assured, though, that simple as this presentation may sound, it took a lot of work to implement provisionally. Doing it gracefully would require even more time and expertise. Today, multimedia is for the professional user. ■

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files, a *Windows*-compatible paint program such as *PC Paintbrush Plus* for *Windows*, and *TIE* Paint, the program's graphics editor. In practice, the cut and paste operation failed about half the time, even with expanded memory loaded.

In *TIE*'s defense, importing graphics in the more memory-efficient Metafile format yielded better results. And if your art needs are minimal, you might create simple vector images directly in *TIE* Paint.

COMPILER GLITCHES

Though you create *TIE* presentations under *Windows*, running them requires a DOS runtime version of the program. But first you must generate and compile Global Information Systems' Tutor code. Glitches and oversights make this a frustrating process. For example, the crucial Key Input/Timed Pause icon would not compile properly, though individually the Key Input and Timed Pause components worked flawlessly. The technical staff at Global Information Systems advised me to bypass the problem by substituting an In-Line Code icon and entering the one-line instruction manually.

> Custom code blocks are the only way to tap some of *TIE*'s advanced features, such as animation.

It also took a call to tech support to clarify the use of a system variable for keyboard input. The manual was no help with this problem; it barely explains what variables are, and neglects to list the basic system variables. Yet the code will not compile if a variable is left undefined.

The manual also lacks any information on the various utilities needed to communicate with the videodisk player via the serial port. Two memory-resident utilities that ship with *TIE*, as well as the Vmode command supplied with the Sony SMI-3081 video board must be loaded before running the compiled lesson, to initialize the videodisk player and set the transparent overlay color. Because the utilities differ depending upon whether you are using the *Windows*-based authoring system or the DOS-based compiled lesson, be prepared for some frustrating trial and error before getting the videodisk up and running.

HALF A LOAF

If fiddling directly with code to fix problems appeals to you, you'll be thrilled to know that *TIE* gives you direct access to uncompiled Tutor code via the *Windows* Notepad. Sadly, creating a custom code block is the only way to tap certain advanced features of the program, such as animation routines and vector font editing. Relying purely on the supplied icons limits you to crude animations (crunching through a large number of bitmap display screens) and only three typefaces.

Global Information Systems will soon release a new version of *TIE* that the ven-

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dor says will address the memory management problems and will add an animation icon as well. But at a list price of $2,500, Global owes its users an upgrade that imports graphics and text files directly and does not rely on the *Windows* clipboard.

> At a list price of $2,500, Global owes *TIE*'s users an upgrade that imports text and graphics files directly.

Other needed improvements include easier access to systems variables and external fonts, on-line help that really works, and rewritten documentation.

In the meantime, while *TIE* can yield multimedia presentations that truly qualify as info-tainment, making this happen requires patience and persistence. ■

OUR CONTRIBUTORS

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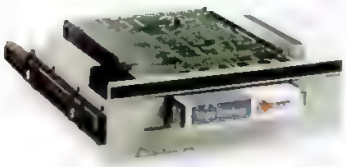

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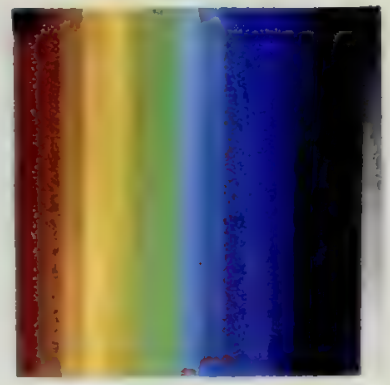

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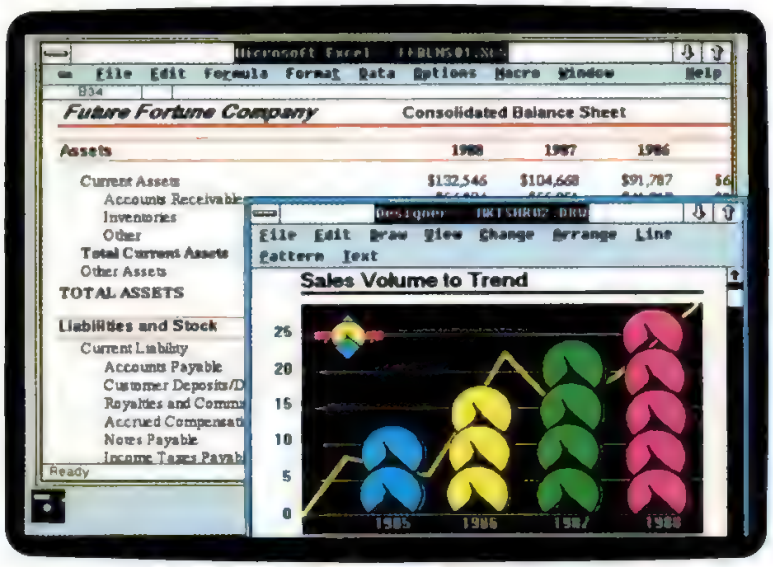

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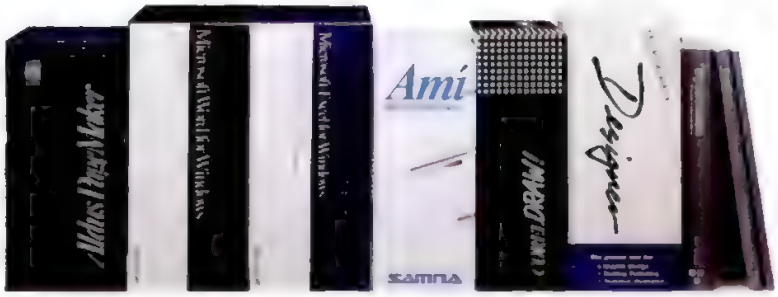

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Putting Your PC on Tape

Recording your computer screens on videotape isn't as easy as you'd think: PCs and VCRs aren't on speaking terms. These four VGA-to-NTSC boards translate your VGA graphics to the language of television.

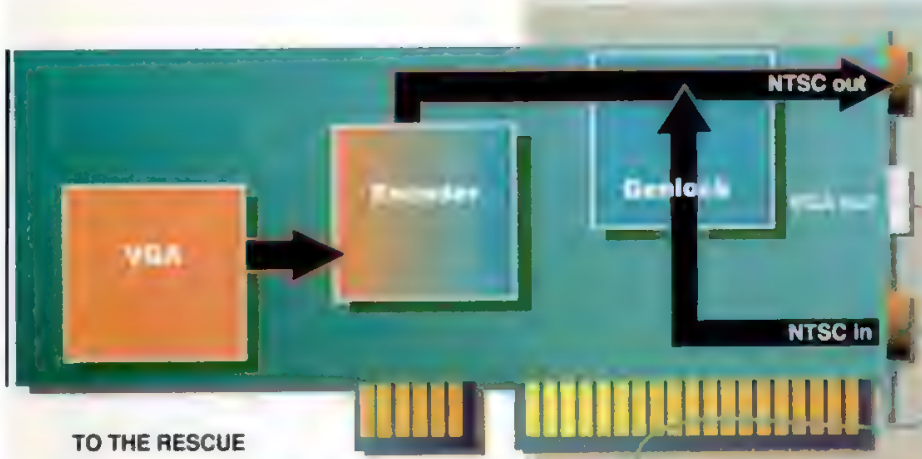
by Lori Grunin

The low cost and high popularity of videocassette recorders make videocassettes an attractive way to distribute information. While you can circulate a PC-generated presentation or tutorial on disks, videocassettes let you reach the larger, VCR-owning audience, as well as adding the attraction of voice-overs and the ability to mix in live video footage.

Unfortunately, the output from your computer's VGA adapter is incompatible with the interlaced signal defined by the National Television Systems Committee RS-170A standard (usually just called NTSC) for broadcast television. First off, the horizontal scanning frequency of a VGA adapter is 31.47 kHz, double the 15.734 kHz of an NTSC monitor. Moreover, the analog VGA display has separate lines for the red, green, and blue signals, plus a fourth line for the sync signal (which tells the CRT's electron gun when and where to begin a new line or a new screen). In an NTSC monitor, all this information is packed into a single, composite signal.

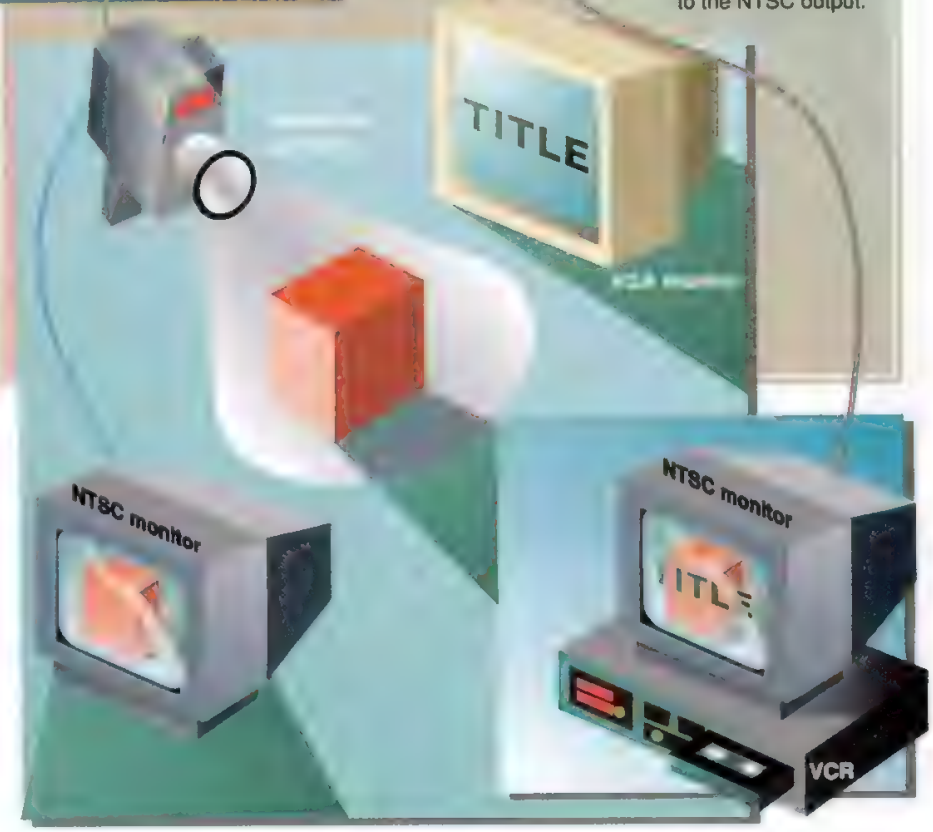
PHOTOGRAPHS: THOM O'CONNOR

VGA-TO-NTSC BOARDS: How They Work



VGA signals (either generated on the VGA-to-NTSC board itself or passed through from an external VGA adapter) are converted by the encoder to NTSC signals that can be recorded on videotape or displayed on a composite television monitor.

If the VGA image is to be overlaid on a video input, the converted signal is passed to the genlocking module, which synchronizes it with the external video signal and sends the combined image to the NTSC output.



TO THE RESCUE

The solution is to use a VGA-to-NTSC encoder, either an external box or a PC add-in board, which sits in the circuit between your graphics output and VCR video input ports and performs the necessary modulations to convert the VGA signal to an NTSC signal. With an encoder, you can record whatever you see on your computer screen onto videotape. Several companies, including Jovian Logic, Willow Peripherals, and USVideo, offer encoder boards for the PC.

If you want to combine your VGA graphics with a video signal—input from a camcorder or VCR, for example—you need an encoder that allows *genlocking* (synchronizing the inputs from both sources to produce a stable image). A handy feature, genlocking lets you generate titles and other text for video clips on your PC, as well as superimpose graphics overlays or even computer animations on top of a video background.

Though VGA-to-NTSC encoders accept video input, they differ from image capture boards (also known as frame grabbers) in that they don't let you capture or manipulate the incoming video images. Image capture boards actually digitize the frames from the video source, storing them on your hard disk as high-resolution graphics files you can edit with paint software or display on your PC monitor in its native VGA mode.

VGA-to-NTSC encoders also differ from TrueVision's Targa 16 board and its workalikes. Targa boards can generate 262,144 simultaneous colors at a resolution of 512 by 512 pixels, and their output is an NTSC-compatible interlaced signal that can be displayed on a composite video monitor. They support genlocking and can also digitize video images and store them on disk in a custom .TGA file format. But although Targa boards produce much more realistic-looking images than VGA boards, they cost about three times as much, and you'll need an additional composite monitor and software with special drivers in order to use them.

Finally, it's important to note that these boards won't let you play video from a VCR or videodisk on your PC screen. For that, you need a motion video board such as the Sony SMI-3081 or the Videologic DVA-4000, which can convert an NTSC video signal and pass it along to your graphics board for display on your VGA monitor.

THE PRODUCTS

In this review, we look at four VGA-to-NTSC encoder boards with genlocking capabilities: Magni Systems' VGA Producer, Questel's CGV-10, USVideo's VGA/NTSC Recordable (with its Genlock Overlay Module), and Willow Peripherals' VGA-TV GE/O. All were production versions ready for shipment, though the Willow product was only in limited distribution at the time we tested. Another board, the Vision VGA from Vision Technologies (a subsidiary of Everex) was announced but not yet shipping at the time we tested.

All but one of the boards double as VGA adapters (the Magni VGA Producer passes VGA signals through from a separate graphics card). Some of them support 800-by-600 modes as well, though these can't be output to NTSC. Note, however, that the USVideo and Willow cards require you to use a multiscanning monitor if you plan to view the VGA image while generating an NTSC signal; in this mode, the signal on the VGA connector is interlaced and scans at 15.734 kHz, incompatible with the 31.47 kHz noninterlaced signal required by a fixed-frequency VGA monitor.

EDITOR'S CHOICE

- **Magni VGA Producer**
- **USVideo VGA/NTSC Recordable**

Though none of these boards adheres strictly to the standard set by the NTSC baseline signal, two are well adapted for both recording and overlaying, and deserve our Editor's Choice.

The ability of the Magni VGA Producer to accept an external sync source for combining multiple video inputs with VGA makes it the most attractive choice for professional use. At $1,695 plus the price of a VGA card, it can cost several hundred dollars more than its competitors, but in return it performs strikingly better, yielding truer colors, more stable composite output, and more sophisticated control over color keying and special effects. Its requirement for a separate VGA adapter with a socketed DAC is its only real limitation, but this can be an advantage if you prefer a third-party VGA card or if you want to use a standard VGA monitor while the board is in NTSC mode.

For less exacting users, USVideo's VGA/NTSC Recordable ($799, plus $399 for the Genlock Overlay Module) is a practical and less expensive solution. Although its NTSC video test results are unspectacular, it produces a good-looking image in practice, and its well-designed software gives you easy control over color keying and output. Keep in mind, however, that you'll need a multiscanning monitor that supports a 15.734-kHz horizontal scan rate if you want to see VGA output on your computer display when in NTSC mode.

We concentrated our analysis on the quality of the boards' composite video output, however. Our performance tests included measurements of the signals generated and their synchronization quality (see the sidebar "Is It Broadcast Quality?") in addition to our standard PC Labs VGA hardware benchmark tests. We also tested the boards visually by overlaying *Autodesk Animator* flics on video input supplied by a VHS camcorder. We displayed the resulting combined image on a high-quality composite video monitor for inspection, and we also recorded it on a consumer VCR.

In addition to output quality, we judged the products on their ease of use and their flexibility in overcoming the problems inherent in encoding and overlaying PC output. In particular, we stressed how much control they give you over *color keying* (the ability to select which VGA color will be treated as transparent when it's overlaid on a video source).

IN THE END

Keep in mind that the quality of your final video can be only as good as your supporting equipment. Television images have more than 262,000 simultaneous colors. By contrast, your VGA card supports at most 256 colors, so there's a limit to how good VGA images can look at the relatively low resolution of an NTSC monitor. On the other hand, NTSC monitors have a built-in anti-aliasing capability that can smooth some of the jaggies in your VGA text and curves. If the results are not of professional quality in the strict sense, however, this doesn't matter, since consumer VCRs are not known for their wonderful fidelity. For putting your PC presentations on tape, these boards work just fine.

MAGNI SYSTEMS INC.

Magni VGA Producer

by Lori Grunin

Alone among the boards we tested, the $1,695 Magni VGA Producer has no onboard VGA capability. Instead, it works with any VGA card that has a 28-pin socketed digital-to-analog converter (DAC) or a special connector. The VGA Producer board itself performs only the NTSC encoding and genlocking, relying on the VGA card to generate the PC graphics display. One advantage of the separate VGA card is immediately visible: you'll always see a jitter-free, noninterlaced picture on your VGA display. On the other hand, having the extra slot occupied may be a drawback for those with crowded backplanes.

The VGA Producer differs from its competitors in other ways as well. It comes with an external control box that lets you control the key color, fade graphics and video displays into one another at user-defined rates, and cut between the video display and the overlayed display. A slider lets you easily control the relative amounts of computer graphics and video source displayed. Since all functions are controlled through hardware, there is no software to install and no memory overhead to worry about.

The board is also unique in offering two levels of synchronization, or locking: standard and fast. If you have a well-conditioned, stable video source, or if the noise is mechanical rather than electrical, fast locking can shrink the jitter a bit because the board doesn't need to adjust for noise that can cause slight variations in horizontal-line timings. The board accepts an external video sync source, letting you override the internal default synchronization.

WATCH YOUR STEP

Installing the VGA Producer is the toughest part of using it. If your VGA card has a socketed DAC, you must first pull the chip from its socket and replace it with the

FACT FILE

EDITOR'S CHOICE

Magni VGA Producer
Magni Systems Inc., 9500 SW Gemini Dr., Beaverton, OR 97005, (800) 624 6465, (503) 626 8400
List Price: $1,695
Requires: IBM AT or compatible with full-height slots, VGA card with 28-pin socketed digital to-analog converter or custom connector, standard VGA or multiscanning monitor, NTSC video monitor, videocassete recorder.
In Short: An expensive but top-drawer encoder board whose externally controlled color keying and special effects make it the best choice for professional use.

CIRCLE 400 ON READER SERVICE CARD

carrier/connector supplied by Magni. You then reseat the DAC in the carrier and connect the VGA Producer board to the VGA card with a ribbon cable.

This tricky process is made even trickier by manufacturer oversights. The illustration appearing in the manual was a true test of our spatial relations skills: the first time we attempted to follow it we accidentally put the carrier in backwards, then watched dispiritedly as smoke rose from the now-fried encoder board. Compared with this, the threatening forest of solder "spikes" on the back of the card presented a minor hazard. The next time we tried installing it, we circumvented the problem by using a Metheus Premier VGA board, which comes equipped with a special connector for the VGA Producer.

Once installed, however, the VGA Producer was one of the easier boards to work with because it operates almost invisibly. It produced nice, bright colors, and its NTSC output was exceptionally jitter-free. Even regular text-mode characters, normally almost undistinguishable on a composite monitor, were clear enough to read, though you wouldn't want to stare at them for a long time.

The VGA Producer records as well as it displays. The only serious problem with its output was a marked tendency toward overscanning in both the horizontal and vertical directions. With *Autodesk Animator*, whose screen image doesn't run from edge to edge, we were able to fix the problem by using the routines in the external control box, but we weren't able to do so with programs that use the entire display.

The VGA Producer's physical dimensions are also worth a caution. Although it's an 8-bit card, it works only in 286 or 386 machines and, being tall, requires a standard full-height AT slot. A little circuit board at the bottom of the card, which sticks out about three-quarters of an inch, also bears watching.

Those caveats aside, however, the VGA Producer offers excellent output and fine control. If you're willing to pay the price, this is the one to choose.

IS IT BROADCAST QUALITY? TAKING THE MEASURE OF THE BOARDS

by Lou Bottali and Pamela J. Livingston

"Broadcast quality" is something of a buzzword among vendors of NTSC video products for the PC, but the FCC means something very specific by the term—namely, strict adherence to the NTSC specification. We wanted to find out for ourselves what this means to PC users, so we sought a way to quantify the quality of the VGA-to-NTSC boards' output by comparing the composite video signal with a true NTSC baseline.

To do this, we used a Tektronix 1780 Video Measurement Set, a device much like an oscilloscope but specifically adapted for video testing, to analyze the boards' output. Our PC Labs benchmark tests provided a color bar pattern, and the baseline signal was produced by a Tektronix TSC-100 signal generator. Each of the four boards was installed in a 16-MHz Compaq 386 equipped with a Sony GVM-1300 multiscanning monitor. We viewed the results on a Sony PVM-1271Q composite monitor.

The important elements of an NTSC signal are its waveform and timing characteristics, and we tested these factors thoroughly in both free-run, or normal, mode and genlocked mode. We performed more than a dozen tests, of which the four we publish best summarize the important aspects of video quality.

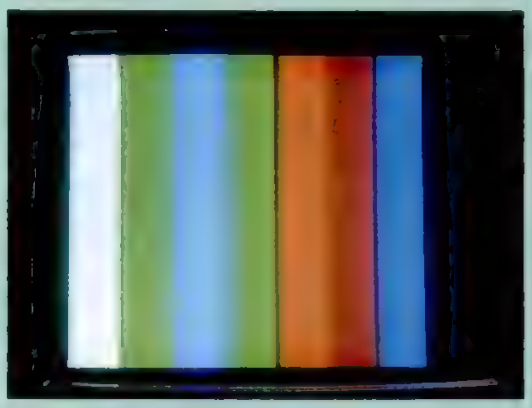
The visual differences between good readings and poor ones show up in the crispness of the image as well as in the intensity and accuracy of the colors. For instance, a low number on the White-Level test would result in a light-gray, not white, image on your video monitor, while a poor showing on the Set-Up test would be apparent in a loss of gradation in the dark areas of the image.

The Subcarrier Horizontal Phase test addresses timing. Problems with this specification would not show up when simply viewing a monitor. You'd notice them only if you were merging the output signal with another video signal input after the fact.

Finally, the High-Frequency Response test is an indirect way of assessing the video resolution: the higher the frequency without significant degradation of the signal, the clearer the image. An acceptable response (under 3.0 decibels of degradation at 4.1 MHz) is considerably better than what consumer video equipment can attain, or even the average TV broadcast. For instance, though laserdisk players perform well at up to 5 MHz and top-of-the line TV monitors are good up to about 7 MHz, the best Super-VHS players on the market start to fall off at about 4.2 MHz, and ordinary VCRs start to drop off significantly at 2 MHz.

Our conclusion? Absolute conformance to spec does give you better picture quality, and this is visible under our test conditions even if it's not always apparent in real life. ■

An oscilloscope and a high-quality television monitor give complementary views of video output quality.



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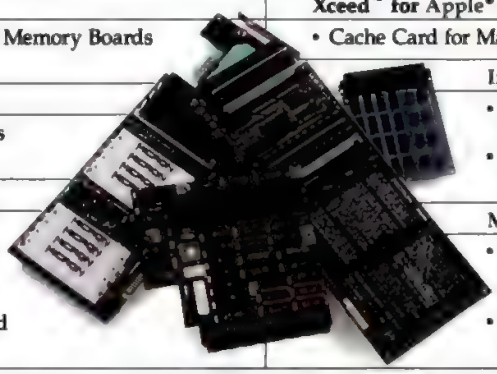

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PERFORMANCE TESTS: VGA-TO-NTSC BOARDS

Three of these four boards replace your VGA card. In return, expect acceptable but not spectacular VGA performance.

Unscrolled BIOS Write
The **Unscrolled BIOS Write** test writes to the display screen via the interrupt 10H BIOS call.

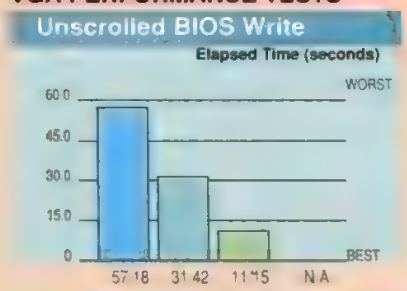
Scrolled BIOS Write
The **Scrolled BIOS Write** test also uses interrupt 10H BIOS calls, but with the slower line-by-line scrolling function.

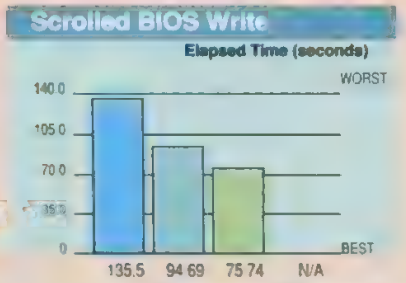
Put Pixel
The **Put Pixel** test draws single pixels on the screen graphically.

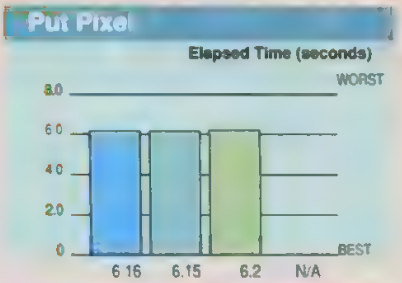
Draw Horizontal Line
The **Draw Horizontal Line** test draws horizontal lines on the screen one at a time.

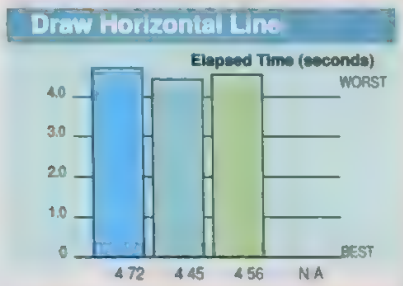
Draw Vertical Line
The **Draw Vertical Line** test draws vertical lines on the screen one at a time.

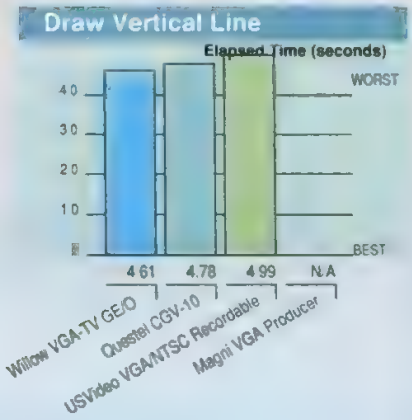
VGA PERFORMANCE TESTS





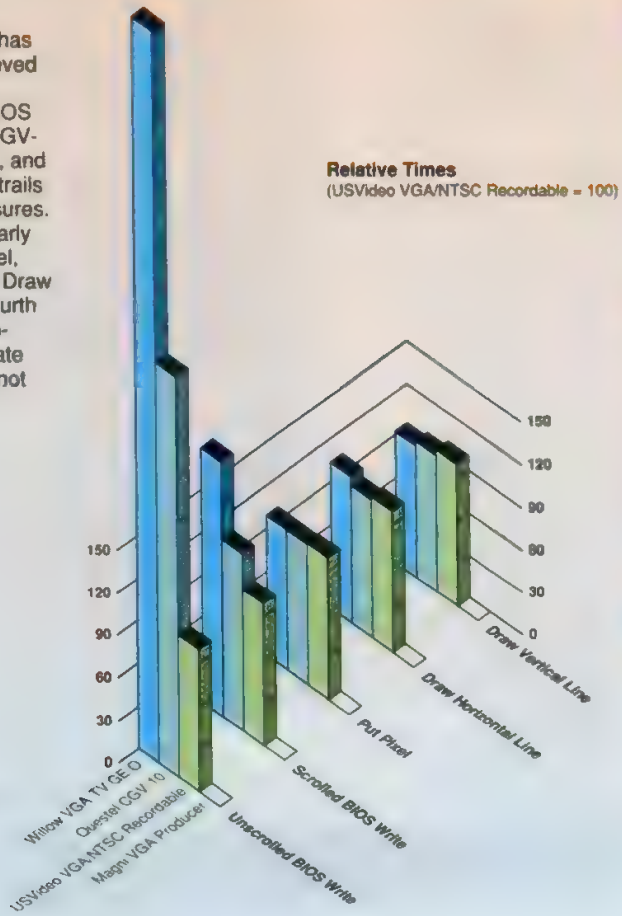






VGA PERFORMANCE TESTS: COMPOSITE VIEW

The USVideo VGA/NTSC Recordable graphics card has the fastest BIOS and achieved the best times on both the Unscrolled and Scrolled BIOS Write tests. The Questel CGV-10 follows in second place, and the Willow VGA-TV GE/O trails well behind on these measures. All boards performed similarly on the other tests (Put Pixel, Draw Horizontal Line, and Draw Vertical Line). Since the fourth board, the Magni VGA Producer, works with a separate VGA card, our tests were not applicable.



N/A—Not applicable. the Magni VGA Producer does not have on-board VGA

QUESTEL INC.

Questel CGV-10

by John R. Quain

At $850, the Questel CGV-10 had the lowest list price of any of the boards we tested, and its video benchmark tests were among the strongest. Off the bench, however, we found many weaknesses. Although the CGV-10 offers sharp pictures, it is handicapped by its inflexibility.

Its Achilles heel immediately shows up when overlaying titles and graphics on video. In this application, the ability to key out specific colors, making them transparent, is critical, especially with complex designs. But in the tradition of Ford's creed that you can have any color you like as long as it's black, the Questel CGV-10 offers only one key color: black (although it can be inverted to white). This means that your titling software (Questel recommends Entropy Engineering's $495 *Video Titler* package) must be written to support the board's color keying facilities if you want any other color to be transparent. Your standard graphics software isn't likely to support it.

BETTER VGA OUTPUT

A convenient feature of the CGV-10 is its VGA connector, which can support a standard VGA monitor running at 31.47 kHz at the same time that you're displaying the NTSC signal. In contrast, the USVideo and Willow boards require you to use a multiscanning monitor capable of running at 15.734 kHz, the NTSC standard, to display graphics on a PC monitor and an NTSC monitor simultaneously.

The CGV-10 board had some of the best results in our High-Frequency Response test. Its output showed no signs of rolling off at 4.1 MHz, the limit of our test equipment. This translates into about 320 horizontal lines of resolution, which is far better than the average consumer VCR.

Though the Questel board was bested only by the Magni VGA Producer at delivering accurate colors, its NTSC output revealed a bit of horizontal overscan, which means that some screens might be slightly cut off at the sides after videotaping. However, Questel does provide a utility for shrinking the image vertically.

The Questel CGV-10 delivers a sharp, saturated picture for a reasonable price, but you'll have to make operational sacrifices to get it. It serves well to record VGA on videotape, but if you need to do any overlaying, you'd be better off with another board.

USVIDEO INC.

USVideo VGA/NTSC Recordable

by John R. Quain

Though it didn't win any of the individual races, USVideo's VGA/NTSC Recordable card scored enough points in our

FACT FILE

Questel CGV-10
Questel Inc., 10175 Joerschke Dr., Grass Valley, CA 95945; (916) 477-5000.
List Price: $850
Requires: IBM PC-XT, AT, or compatible; standard VGA or multiscanning monitor; NTSC video monitor, videocassette recorder.
In Short: This competitively priced board produces clean NTSC output signals, and its ability to use a standard VGA monitor while in NTSC mode is a nice plus. But its utility for overlay work is severely limited by an inflexible color keying scheme.

CIRCLE 401 ON READER SERVICE CARD

BENCHMARK TESTS: VGA-TO-NTSC BOARDS

Our NTSC video benchmark tests measure adherence to the NTSC RS-170A specification that defines "broadcast-quality" television (see the sidebar "Is It Broadcast Quality?").

None of the four boards we tested produced poor images: in fact, the pictures look a lot better than anything your VCR can produce. But close inspection on higher-quality video equipment shows some degradation in the output from the lower-rated products.

Poorer results on the White-Level test cause the whites to appear grayer on the video monitor. The output of the top performer on this test—the Magni VGA Producer—was quite bright, while that of the worst—the USVideo VGA/NTSC Recordable—was noticeably dimmer.

On the Setup test, poor numbers represent a loss of detail in dark areas of the image, with less gradation between dark colors. Only the Magni VGA Producer, which addresses setup in hardware, proved to adhere to the specification.

Only the USVideo VGA/NTSC Recordable was out of spec on the Subcarrier Horizontal Phase test, which addresses timing. Very poor results can cause problems when you are joining two signals during editing or dissolving.

All the boards were within the acceptable range on the High-Frequency Response test. However, the USVideo VGA/NTSC Recordable came close to the outer limit of the range, and some loss of crispness in the audio signal was noticeable as a result.

	White-Level (IRE units)*	Setup (IRE units)*	Subcarrier Horizontal Phase (degrees of phase shift)	High-Frequency Response (decibels at 4.1 MHz)
Willow VGA-TV GE/O	89.0	0.0	3.1	-0.5
Questel CGV-10	98.0	-4.3	2.7	0.0
USVideo VGA/NTSC Recordable	72.0	0.0	12.7	-2.8
Magni VGA Producer	100.0	7.5	4.3	0.0
NTSC baseline signal	100.0	7.5	0.0	0.0

The **White-Level** test measures the amplitude of the video signal when scanning a white portion of the image.

The **Setup** test measures the *setup* or *pedestal* level—the amplitude of the video signal when scanning a black portion of the image.

The **Subcarrier Horizontal Phase** test describes the relationship of the color subcarrier phase to the start of the horizontal sync. The subcarrier is a sine wave whose amplitude and phase convey color information. The test is run with genlocking activated. The acceptable range for the Subcarrier Horizontal Phase test results is ± 10.0 degrees.

The **High-Frequency Response** test records the amplitude loss (in decibels) when an audible NTSC signal is generated at 4.1 MHz. It is run with genlocking activated. The acceptable range for High-Frequency Response test results is from 0 to −3.0 decibels (dB). Decibels are a logarithmic measurement.

*One IRE (Institute of Radio Engineers) unit = 1/140 the amplitude of the NTSC signal.

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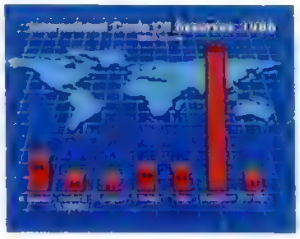

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Lotus Freelance Plus 3.01

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Software Digest's award was presented for Freelance Plus Release 3.0. Release 3.01 is identical, but uses less memory.

series of tests to come out ahead in the overall standings. The $799 board requires an additional $399 Genlock Overlay Module in order to overlay on top of video, which puts it in the upper price range—but it's still cheaper than the Magni VGA Producer. Though its video benchmark scores look disappointing, our hands-on evaluation left us not only pleased at how easy the USVideo product was to use, but more than content with the videotaped results.

The VGA/NTSC Recordable is a single full-length, 16-bit board. Unfortunately for the space conscious, the Genlock Overlay daughterboard overhangs enough to block an extra slot. There's a three-position toggle switch for selecting the mode: NTSC only, VGA only, or simultaneous NTSC and VGA. Using it to change from NTSC to VGA-only output requires rebooting, though you can make this and other mode changes through software.

EASY TO USE

The VGA/NTSC Recordable has excellent software to facilitate its use with a variety of graphics packages. The self-explanatory menus made it easy to lay down our animation sequence over video and videotape the whole scene within minutes. Changing the key colors of a detailed graphic created with *Autodesk Animator* was made equally easy by USVideo's *Barset* program, a TSR that lets you switch through the key colors while viewing the video on-screen to see which looks best. Other TSRs let you change board parameters and create customized configuration programs.

At first glance, the USVideo card's benchmark scores are unimpressive. Its VGA performance is certainly up to par, and its VGA output in NTSC mode was the clearest we encountered. But when it comes to the NTSC video tests, the numbers seem lukewarm. We should hasten to note, however, that none of the potential problems that these measurements indicate ever occurred in our testing.

For instance, even though the board's video frequency response was down by a full 2.8 dB at 4.1 MHz and the reduction in crispness was apparent on a pure test signal, the loss of picture detail would likely be unnoticeable to the average viewer. In any case, the resolution of most home video equipment is well below the resolution of any of these boards.

Another potential problem with the USVideo board was its genlock subcarrier phase deviation. Really bad performance in this department can create difficulties if you later want to combine the genlocked output with another video source. If you plan to do this, you may want to test the results before you buy.

Overall, we were impressed by USVideo's well-designed software, and all our graphics-to-video presentations came off without a hitch—and with fine clarity. As long as you can spare the slots—and the money—the USVideo is an excellent choice.

FACT FILE
EDITOR'S CHOICE

USVideo VGA/NTSC Recordable
USVideo Inc.,
1 Stamford Landing,
62 Southfield Ave.,
Stamford, CT 06902;
(203) 964-9000.
List Price: VGA/NTSC Recordable graphics card USVGA01, $799; Genlock Overlay Module USVGA03, $399.
Requires: IBM PC-XT, AT, or compatible; multiscanning monitor that supports a scan rate of 15.73 kHz, NTSC video monitor, videocassete recorder.
In Short: Though its external genlocking module takes up two slots and boosts its price above that of its competitors, good output and easy-to-use color keying software make this the most practical all-in-one solution.

CIRCLE 402 ON READER SERVICE CARD

VGA-TO-NTSC BOARDS: SUMMARY OF FEATURES

Products listed in ascending price order

	Questel Inc. Questel CGV-10	Willow Peripherals Willow VGA-TV GE/O	USVideo Inc. USVideo VGA/NTSC Recordable	Magni Systems Inc. Magni VGA Producer
List price	$850	$895	$1,198	$1,695
GENERAL INFORMATION				
Board type	ISA 8-bit	ISA 16-bit	ISA 16-bit	ISA 8-bit
Board size (LWH, in inches)	13 1/4 x 4 1/8 x 5/8	13 1/2 x 3 7/8 x 3/4	13 3/8 x 3 1/8 x 1 1/4	13 1/4 x 4 7/8 x 3/4
VGA CHARACTERISTICS				
VGA support	On-board	On-board	On-board	Pass-through
VGA chip set manufacturer	Cirrus Logic	Tseng Labs	Trident/Zymos	N/A
Video memory:				
Standard	256K	512K	256K	N/A
Maximum	256K	512K	512K	
PC graphics modes:				
CGA (320 x 200 x 16 colors)	■	■	■	N/A
EGA (640 x 350 x 16 colors)	■	■	■	N/A
VGA (640 x 480 x 16 colors)	■	■	■	N/A
640 x 480 x 256 colors	□	■	■	N/A
800 x 600 x 16 colors	■	■	■	N/A
800 x 600 x 256 colors	□	■	□	N/A
NTSC VIDEO CHARACTERISTICS				
Encoder chip manufacturer	Motorola	Motorola	Motorola	None*
Video output types:				
NTSC composite	■	■	■	■
S-video	□	■	□	■
RGB analog	■	■	■	□
Accepts external sync	□	□	□	■
Color keying control	Software	Software	Software	Hardware

—Editor's Choice ■—Yes □—No
N/A—Not applicable: the Magni VGA Producer does not have VGA on-board.
*The Magni board has custom analog circuitry for encoding.

WILLOW PERIPHERALS

Willow VGA-TV GE/O

by John R. Quain

Like the Questel CGV-10, Willow's VGA-TV GE/O ($895) offers a competitively priced way to overlay VGA graphics on a video picture and to record the results on videotape. In this case, however, the savings in cash are offset by a lack of some basic capabilities.

The VGA-TV GE/O is a full-slot, 16-bit board that comes with the usual array

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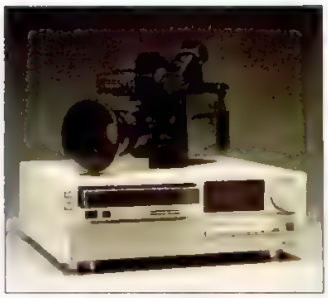

BROADCAST QUALITY

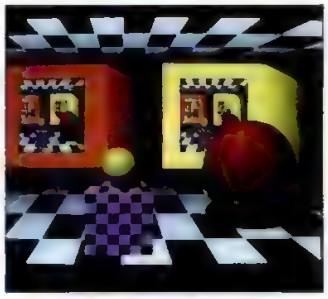
NTSC/VHS

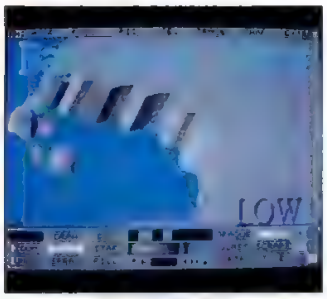
S-VHS

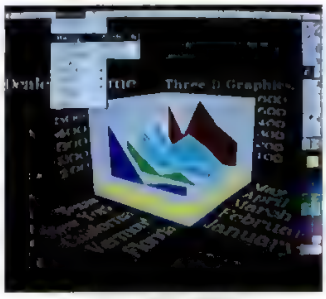
TRANSITION EFFECTS

OVERLAY (ANY-COLOR KEY)

FADE


640 x 480 256 COLORS


ANY SOFTWARE


ANY SOFTWARE

ANY SOFTWARE

ANY SOFTWARE

"VGA Producer... [gives] you many of the same capabilities as professional video-effects equipment that costs over ten times as much... The system is so easy to use that you may well find yourself using all but the most sophisticated features just by following your instincts."

PC Magazine
28 Nov 1989

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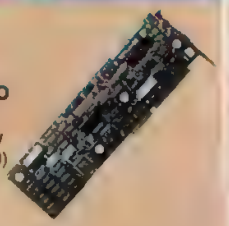
FACT FILE



Willow VGA-TV GE/O
Willow Peripherals, 190 Willow Ave., New York, NY 10454; (800) 444-1585, (212) 402-0010.
List Price: $895
Requires: IBM PC-XT, AT, or compatible; multiscanning monitor that supports a scan rate of 15.75 kHz; NTSC video monitor, videocassete recorder.
In Short: The Willow VGA-TV GE/O's NTSC video benchmark test sccores look good, but its jittery VGA image while in NTSC mode belies the numbers. Until the vendor releases software for changing the key color, it's unsuited for overlay work.

CIRCLE 403 ON READER SERVICE CARD

of terminals and jacks for VGA and NTSC devices. A notable feature is its S-connector for output to Super VHS video equipment. Recording on S-VHS gear can offer a visible increase in resolution, which makes the VGA-TV GE/O particularly appealing for graphics genlocking applications—at least in theory.

Unfortunately, what isn't supplied is the software you need to let you change the key color, so it's impossible to make the different VGA colors transparent for overlaying on NTSC video. Currently, your only choice is the default key color of black. The company says a software utility to change the key color will be forthcoming, but this was not available for evaluation.

MORE THAN MEETS THE EYE

This limitation aside, the VGA-TV GE/O easily accomplished all the tasks necessary to put computer-created graphics over video footage or directly onto videotape. It also achieved some of the better benchmark test results, and its High-Frequency Response scores, in particular, were very nearly ideal.

Nevertheless, when put to the visual test, the VGA-TV GE/O's output proved wanting. When there was no video source, for example, the colors created by the board's internal NTSC generator were more noticeably skewed than its competitors' (though, to be fair, this symptom was manifested to one degree or another in all of the boards we tested).

A more serious problem was the severe jitter in the unit's output to the VGA monitor while in NTSC mode; indeed, it was difficult for us to read a DOS directory. This was not a problem with the other boards—even in the USVideo VGA/NTSC Recordable, which, like the Willow, puts out an interlaced signal in this mode.

Overall, nothing the VGA-TV GE/O board did would cause you to weep with frustration, but it didn't particularly distinguish itself, either. And its lack of keying control is a severe handicap if you plan to do any overlay work. The board's incomplete software and documentation makes us suspect that the product hasn't yet firmly taken root. ■

Lou Bottali *is a process engineer for Full Color Computing Inc. in Ridgefield, Connecticut.* **Lori Grunin** *is a staff editor at* PC Magazine. **Pamela J. Livingston** *is the project leader in charge of graphics and multimedia coverage at PC Labs.* **John R. Quain** *is the associate editor of* Video Review *magazine and the executive editor of* Audio Review *magazine.*

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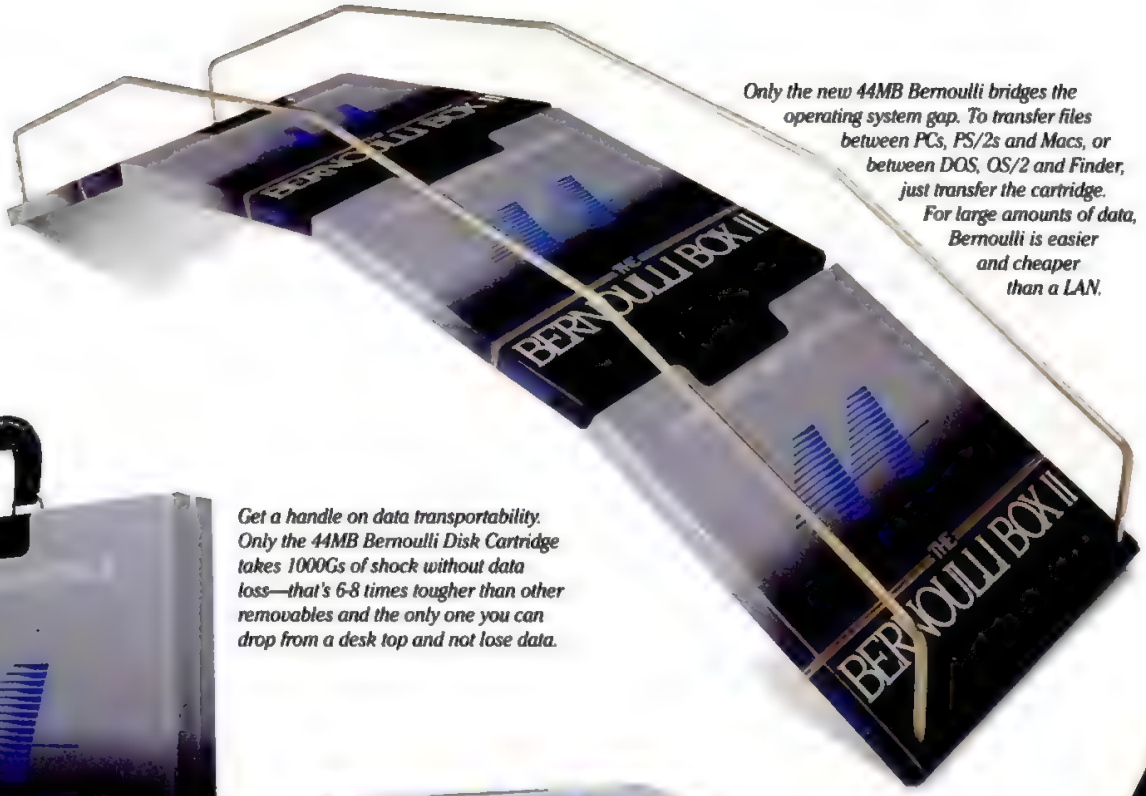

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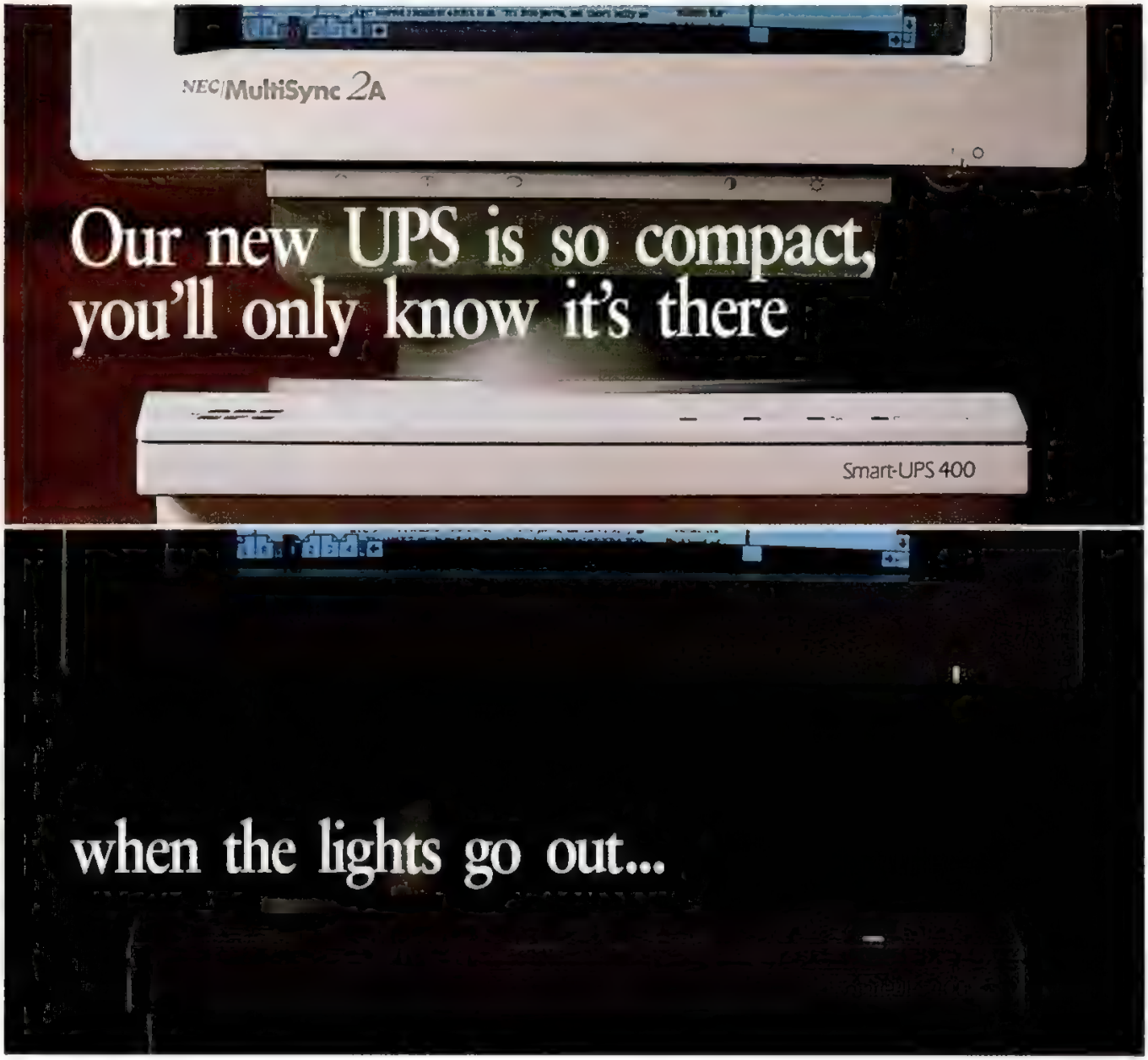

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READERS CHOICE 1990

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CIRCLE 281 ON READER SERVICE CARD

A year ago, the best-buy 386 was a 20-MHz machine. Now, the demise of the 16-MHz 386 and the shrinking price gap between 20- and 25-MHz models are making the 386/25 the choice for many PC buyers.

THE 386/25: THE MIDRANGE OF TODAY

by M. David Stone

How quickly perspectives change! When Compaq introduced the first 386 machine, a 16-MHz Compaq Deskpro 386, in September 1986, it immediately set new performance standards for the PC. In September 1987, the Compaq Deskpro 386/20 appeared, followed in June 1988 by the Compaq Deskpro 386/25. When we published our issue of May 30, 1989, 25-MHz 386s were considered "screamers"; the only 33-MHz 386 at the time was the Zenith Z-386/33, which had just hit the market. Today, with 33-MHz 386 systems widespread, and with 25-MHz 486 systems appearing in the $4,000 to $6,000 range, 386/25 computers have taken over the midrange of the 386 market.

In our issue of November 28, 1989, *PC Magazine* ran a follow-up evaluation of 25-MHz 386 machines. For the current issue, PC Labs has tested 23 more 386/25 PCs—from Altec, ARC, AT&T, Blackship, Club AT, CompuAdd, Computer Market Place, Data General, DEC, Epson, ESI Automated Office Systems, Gateway 2000, IBM, NCR, Pan United, PaoKu, Polywell, Star Industries, Tandy, Tatung, Telemart, Toshiba, and Tri-Star.

You can get an idea of the increasing speed of the 386 machines from the benchmark test results we've published for the Compaq Deskpro. In the 80386 Instruction Mix test, the 16-MHz model clocked in at 4.01 seconds, the 386/20 at 2.91, the 386/25 at 2.36, and the 386/33 at 1.66. Compared with an 8-MHz IBM PC AT, which requires 8.96 seconds to run the 80286 Instruction Mix test, the same machines are 2.23, 3.08, 3.80, and 5.40 times as fast, respectively.

As these results show, the 25-MHz 386 has already become a midrange computer. It is quite clearly a step up from the 386SX that is today's de facto entry-level system, but it's just as clearly a step down from a 386/33 or, for that matter, a 486/25. It's no longer the single user's preferred speed demon for CAD or desktop publishing. As a file server, the 386/25 still functions well enough for most network applications since its tasks are seldom CPU-bound. Nevertheless, the number of server-based applications is likely to grow significantly in the next year, and the 386/25 is not likely to remain a network server of choice. But as a midrange system, with steadily falling prices, it's an increasingly attractive option for users moving to *Microsoft Windows* or other graphics-based environments that feel sluggish on lesser machines.

BUYER NOTES

Prices on the 386/25s have dropped significantly since last year. For example, consider the 25-MHz System 325 from Dell Computer Corp., one of the better known direct mail-order companies. A year ago, that machine with 4MB RAM, a 90MB hard disk, and a VGA color display sold for about $7,600. Today, the same system sporting a 100MB hard disk in place of the 90MB drive sells for about $4,900.

Indeed, other companies' prices today hover closer to the $4,000 mark than they do to the $5,000 range. One year ago, there wasn't a single system available with 4MB RAM, a 100MB hard disk, and a VGA monitor for less than $4,500. In the current crop of machines, nearly half of the systems are available with that configuration at a list price of under $4,250.

You can often get further discounts on machines sold through retail dealer channels. Among the computers in this review that are distributed through dealers are the ARC, Club AT, CompuAdd, DEC, Epson, ESI Automated Office Systems, IBM, NCR, Tandy, Tatung, and Toshiba machines (although the CompuAdd and Tandy are available only at exclusive company-affiliated dealers). Mail-order vendors include Altec, Blackship, Computer Market Place, Gateway 2000, Pan United, Star Industries, Telemart, and again CompuAdd.

> Nearly half of the systems in the current crop are available at list prices under $4,250.

Most mail-order firms have good reputations, and you can often expect to receive excellent service from them. Nevertheless, the first time you order from any mail-order vendor, it may be a wise decision to pay with a credit card. The credit-card agency can often act as a good buffer zone between you and the vendor in case any problems develop with either the transaction or the equipment. Some mail-order firms add a surcharge for any purchases made through American Express, since AmEx keeps a relatively large percentage of the purchase price for itself. You should not expect to see a surcharge for Visa or MasterCard purchases, but be sure to ask about this before buying, because there are some exceptions.

SQUEEZING OUT THE 20-MHz DX

With the prices on 386/25 systems continuing to fall rapidly, the interesting question is whether the 386/25 has effectively killed off the 386/20. The answer is still no at the time of this writing, but that may soon change. The 386/20 is coming under pressure not only from above but also from below.

A year ago, the 16-MHz 386SX began to squeeze the sales of the higher-priced 16-MHz 386 systems (also known as 386DX systems) as well as 286 machines. This year, the new 20-MHz 386SXs are exerting the same effect on 20-MHz 386DX systems. Buyers of 386DX systems want something better than entry-level speed. Since only a handful of vendors still sell the former 386DX entry-level model, the 386/16, the 386/20 has effectively taken its place. But when you can choose a 20-MHz 386SX or a 25-MHz 386DX, is there any reason left to buy a 20-MHz 386DX?

The answer, of course, depends on performance and price structure. With the first 386SX/20 systems just out, tests at PC Labs indicate that their performance overlaps the low end of the 20-MHz DX systems. At this writing, however, prices favor the 20-MHz DX. For example, Northgate's 20-MHz 386 Slimline, with 2MB of RAM, a 40MB hard disk, and color VGA, is selling for about $2,900. A similarly equipped 20-MHz SX from Dell—the first to show up at PC Labs—is about $400 more. And Dell is selling a cached version of a 20-MHz DX for a mere $200 more than its 20-MHz SX system. It would be surprising indeed if the cached version of the DX system does not turn out to be a significantly better performer than the uncached SX.

Paul Rubin, director of product marketing at Dell Computer Corp., is quick to point out that the relatively small current price difference between Dell's 20-MHz DX and 20-MHz SX comes primarily from a special promotion for the DX. He expects that by the end of this year, the typical price difference between 20-MHz SX and DX systems will be much greater, while the difference between a 20-MHz DX and a 25-MHz DX system—currently about $500—may be narrowed to $200 or $300. From a price/performance perspective, this $500 price difference translates to about 11 percent, compared with performance differences of almost 24 percent on our 80386 Instruction Mix test.

INTEL CHIP PRICING

The most probable scenario runs this way: As Intel's yield of 25-MHz DX chips increases, the price of those chips should fall significantly, while the price of the 20-MHz DX chip remains relatively stable. On the other hand, as Intel's yield of 20-

EDITOR'S CHOICE

- **Gateway 386/25 Cache Performer**
- **Poly 386-25/Cache**
- **MIT 386/25**

Of the 23 25-MHz 386 PCs reviewed here, three merit Editor's Choice: Gateway 2000's Gateway 386/25 Cache Performer, Polywell Computers' Poly 386-25/Cache, and Telemart's MIT 386/25. Three others deserve honorable mention: the CompuAdd 325 and a pair of small-footprint units—the Tandy 4025 LX and its nearly identical sibling, Digital Equipment Corp.'s DECstation 325c.

The Gateway 386/25 Cache Performer, a desktop machine, performed quite respectably on our processor and disk benchmark tests. It's available at a particularly attractive price ($3,495) with a year of on-site service.

The Poly 386-25/Cache, a 16-inch mini-tower, combines aggressive pricing with better-than-average performance and Polywell's exceptional customer policies: a 30-day money-back guarantee, extended warranties, and the option to purchase on-site service.

Telemart's desktop MIT 386/25 displayed consistently strong benchmark test performance, and the mail-order company ships computers free, includes a one-year on-site service contract, and offers a 30-day money-back guarantee.

Honorable mention goes to the CompuAdd 325 for its excellent disk performance and competitive pricing. A hard disk caching controller helps enhance this desktop machine's performance, though we're not convinced that the hardware cache is worth the extra cost unless the PC is being used as a file server.

If you're in the market for a small-footprint PC, the other two honorable mentions are worth considering: the Tandy 4025 LX and the DECstation 325c. These twin machines are not as cheap as mail-order PCs, but they are well built. Since Tandy and DEC haven't signed onto the Super VGA bandwagon yet, their video capabilities go only as high as 640 by 480 VGA resolution, but the benchmark tests indicate the speedy performance of their video systems.

Also worthy of your consideration among the low-cost choices is Computer Market Place's Ultra 386-25C, the cheapest fully configured 25-MHz 386 system at the time of this review. It performed well on our processor, memory, and video tests, yet because of this mail-order vendor's custom-configuration sales policy, we can't guarantee that you will achieve the same results: your machine may have different components.

Likewise, Tri-Star Computers Corp.'s Flash-Cache 386/25 came in low on price, although it scored well above average in our testing. With this desktop machine, you get a two-year warranty, one year of on-site service, and a 60-day money-back guarantee.

What about the best-known brands? We liked the Toshiba T8500 Model 25's excellent construction and its small-footprint design. Unfortunately, you can use only 3.5-inch floppy disks, and the built-in VGA isn't Super VGA. Epson lent its famous name to the Epson Equity 386/25, but this model exhibited lower-than-average performance at a higher-than-average price.

The IBM PS/2 Model 80-A31, the NCR PC386, and the AT&T 6386/25 WGS are all made by well-known companies, and all are well built, but in price/performance comparisons they are top-heavy in expense. Still, these machines are worthy of consideration; if you divide their costs over a five-year life span and take into account the service and support policies, the significance of the price differential shrinks considerably.

MHz SX chips increases relative to the 16-MHz chips, the price of the 20-MHz SX chips is also likely to fall.

The difference in chip prices will be reflected in system prices, so that the price difference between a 386SX/20 and a 386/20 will increase while the difference between the 386/20 and 386/25 decreases. Rubin expects all this to happen by the end of 1990. "By the fourth quarter of this year," he says, "the 20-MHz DX will be under extreme pressure from the 20-MHz SX by price and the 25-MHz DX by price/performance ratio." All of which means that the 386/20 may soon be dead from the buyer's viewpoint, leaving the 386/25 as the lowest level of true 386 system worth acquiring.

Not everyone agrees with this scenario. In particular, Arthur Lazere, Chairman of Northgate Computer Systems, offers an interesting alternative possibility. Lazere suggests that a cached version of a 20-MHz DX machine will significantly outperform a 20-MHz SX for "not very much more money." The price difference, he says, could be as little as $100. If he's right, then the 20-MHz SX is in trouble, not the 20-MHz DX. But then Lazere has never been a fan of the SX. "We don't see the SX as anything to get excited about," he says. Still, he allows that Northgate Computer may produce a 20-MHz SX system—"but only to keep up with the SX mania."

Which of these scenarios turns out to be right depends largely on how aggressive Intel chooses to be in pricing. And given Intel's commitment to the SX, the first scenario seems far more likely. With any luck, by the time you read this, it may be clear whether the 386/20 is dead, or whether it will continue to survive, for now, in a cached configuration. Computer manufacturers' product lines need to reflect different levels of performance; otherwise, buyers will reject some machines that resemble each other too closely.

KEY TRENDS

Whatever the fate of the 386/20, the current crop of 386/25 systems shows several noteworthy trends. Most important in terms of performance is the near-universality of memory cache. Of the 23 systems reviewed here, the only one without RAM caching is Star Industries' Americana 80386-25. All of the other systems came with at least 32K of cache. Three of these machines—Club AT's Club Model

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325Ci, Pan United's PC 386/25 Cache, and Tri-Star's Flash Cache 386/25—can be expanded to as much as 256K of RAM cache.

Another notable trend is the continuing move toward 1.44MB drives. We asked the vendors to send us a system with at least one high-density floppy disk drive. Six systems—Data General's Dasher/386/25k, Digital Equipment Corp.'s DECstation 325c, the IBM PS/2 Model 80-A31, the NCR PC386, the Tandy 4025 LX, and the Toshiba T8500 Model 25—came with 1.44MB drives only. Nine more came with both 1.2MB and 1.44MB drives. Interestingly, the Data General, DEC, Tandy, and Toshiba systems—as well as the Americana 80386-25—are small-footprint designs.

Another trend worth mentioning is the growing emphasis on service and support. Many of the 386/25s reviewed here come with at least one-year on-site service. These include the systems from CompuAdd, ESI Automated Office Systems, Gateway, NCR, Polywell, Star Industries, Telemart, Toshiba, and Tri-Star. Most other companies offer on-site service as an option, and many companies, including Blackship, offer toll-free numbers for technical support.

REVIEW CRITERIA

To be reviewed in this article, machines had to be 25-MHz 386 PCs with FCC Class B certification, shipping as of mid-spring 1990, and not reviewed in *PC Magazine*'s previous roundups of the 386/25 category (May 30 and November 28, 1989).

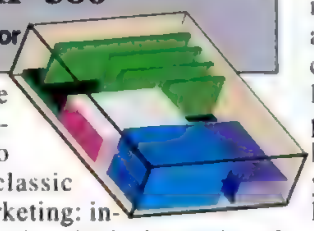
Class B equipment has passed more-stringent requirements for radio-frequency emission and because of its quality of construction is approved for residential use as well. Since many midrange systems are likely to wind up in power users' home offices, we did not accept for review machines that have not yet received Class B certification from the FCC. ("Class B pending" is a term vendors use; it carries no legal weight.) Class A equipment—the other choice—is approved for use in non-residential areas only.

Thus, about 20 systems were removed from consideration in this overview either because of their Class A status or because although the vendors have applied for Class B status, approval is still pending. These include systems from Arche Technologies, Boss Technology, Bus Computer Systems, CAF Technology, Coté, Everest, Master Info Systems, Mitsuba, Multi Micro, Power Computer Systems, PC Brand, Premier Computer Innovations, Spear Technology, Tangent, Swan Technologies, WAA, Wang Laboratories, Zenith, and Zeos International. We also eliminated the Dataworld Data 386-25 because the system that arrived at PC Labs proved to be out of spec. Some of these additional systems may have been given Class B ratings by the time you read this. The systems reviewed here, however, are available today with Class B ratings.

ALTEC TECHNOLOGY CORP.

Altec ZIP-386

by Alfred Poor



The worldwide success of Japanese auto makers is a classic lesson in marketing: include all the options in the base price of your product. The folks at Altec must have been paying attention when they began marketing the ZIP-386. While you can purchase the machine in *PC Magazine*'s "standard configuration" for $2,995, the Altec marketers prefer to emphasize a $3,325 configuration that includes everything but the kitchen sink—in a desktop machine that provides above-average features for below-average cost.

In this case, the kitchen sink includes 4MB of RAM, a 150MB ESDI hard disk, both 5.25- and 3.5-inch floppy disk drives, a 16-bit ATI Wonder VGA card with 512K memory, and your choice of the Super VGA NEC 2A or 1,024 by 768 (interlaced) Tatung 1496X monitor, plus DOS, the paint program *Dr. Halo*, and a mouse.

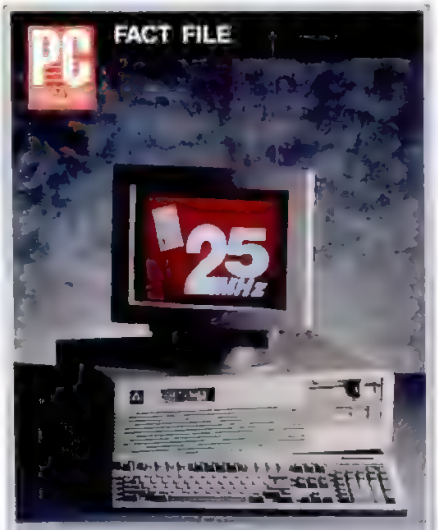
If you want a more modest system, Altec adjusts the price downward. At $2,995, the tested configuration (with 105MB hard disk, color VGA display, and no mouse) was one of the cheapest in the group.

Aside from its pricing, the ZIP-386 is fairly typical. It has an AT-style desktop case, uses the Chips and Technologies chip set and AMI BIOS, and comes with a 32KB static RAM cache for system memory, driven by an Intel 82385 controller chip. There is no memory on the motherboard; it all resides on a proprietary 32-bit card with room for 8MB. (A 16MB card is also available as a no-cost option, using SIMMs instead of separate DIP chips.) The front of the case has a set of reset and turbo switches, a case lock, and several indicator LEDs.

The ZIP-386 offers a few interesting wrinkles in its configuration. The standard ESDI controller has a read-ahead cache, which some refer to as an on-board buffer; the 32K of memory on this card can increase performance on disk reads. According to the documentation and an Altec representative, the turbo switch does not change the CPU clock speed; it merely disables the system cache on the motherboard, which normally slows down the system.

Our evaluation machine came with an unusual keyboard. On this Focus Electronic 3001 keyboard, a group of extra keys around the numeric keypad form a built-in calculator, which you can use without leaving your application. The results appear in a small LCD window above the keypad. You may find this handy, but if you prefer, you can order the familiar 101-key keyboard instead.

The ZIP-386 does show signs of a few



Altec ZIP-386
Altec Technology Corp., 18555 E. Gale Ave., Industry, CA 91748; (800) 255-9971, (818) 912-8688.
List Price: With 4MB RAM, 105MB hard disk, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, VGA monitor, one parallel and two serial ports, game port, DOS 3.3, $2,995; with 150MB hard disk, mouse, $3,325.
In Short: The Altec ZIP-386 is a "kitchen sink" system: everything comes standard in the most widely advertised configuration, including a mouse and graphics software. The machine falls a little short on cosmetics and documentation, but experienced users will find its components and performance an excellent value.

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cut corners, as might be expected in a system with such a low price. In the manual, a brief 13-page section offers some quick-start information, but timid or novice users may not find much comfort in it. There is a mention of tech support and the idea that you can call a toll-free number, but the number is not listed anywhere. The rest of the manual's contents are fairly typical of low-cost systems. The booklet about the motherboard is a cut above average, with decent writing and lots of useful illustrations, but the pamphlets covering the other components are shorter and less useful.

The fit and finish of the system also leave something to be desired. The steel cover of the case has rolled edges that can catch on the back of the chassis, making it difficult to remove. Such problems are annoying or aesthetically unpleasant, although they should have no effect on the unit's performance and durability. And where some companies offer a year of on-site service, Altec covers only the first four months; after that you must ship your machine back to the company for warranty repair.

The Altec ZIP-386 is a more-than-adequate system at an attractive cost. I suspect that many users will appreciate the company's all-included pricing policy, instead of having to pay extra for the options. The internal components and design seem solid, and the only cut corners are in the documentation and cosmetics. While the Altec may not be the ideal choice for an unskilled user, experienced computer users should find it an excellent value with good performance.

AMERICAN RESEARCH CORP.

ARC 386s/25c Skyscraper

by M. David Stone

American Research Corp. builds its ARC 386s/25c Skyscraper as a tower. At 23.5 inches high by 6.75 inches wide by 18 inches deep, the Skyscraper isn't much larger than a standard AT set on end. Yet the tower configuration offers plenty of room for expansion—but not in the best way it could have been implemented.

While the standard configuration has a list price of $4,300, you can buy the Skyscraper nearly empty and configure it to taste. The base price of $2,182 includes 1MB of RAM, one 5.25-inch floppy disk drive, one parallel and two serial ports, and DOS 3.3 or 4.01. The $4,616 tested system included a total of 4MB RAM, a 150MB hard disk and controller, high-density 3.5-inch and 5.25-inch floppy disk drives, a VGA card and Samsung monitor, DOS 4.01, *Microsoft Windows 386*, and a Microsoft Mouse. The warranty includes two years' parts and labor on the system board and one year on everything else. Warranty service is on a return-to-dealer basis, with optional on-site service available from Video Aid Corp.

Inside the Skyscraper is an ARC motherboard with the ZyMOS Poach chip set, Phoenix BIOS, 80386-25, and a coprocessor socket for an 80387, Weitek 1167, or Weitek 3167. According to ARC, you can set the socket for a 16-, 20-, or 25-MHz 80387 using a jumper on the motherboard. (The tested system did not have a coprocessor installed.)

All 32-bit memory in the system resides on the motherboard, with 16 SIMM sockets allowing a maximum of 16MB RAM. The SIMM sockets are located between the slots and power supply, where you can reach them easily. The test unit had four 1MB SIMMs installed, using 80-nanosecond DRAM.

Also on the motherboard is an Austek cache controller and 32K of 25-ns. static RAM cache. But despite the cache feature, the Skyscraper's performance was well below average on PC Labs' processor and memory tests. On the other benchmark tests, the system fared a little better, with midrange results for the video tests, and scores on the disk tests that ranged from below average to better than average. The overall performance is somewhat below par.

The ARC motherboard sports two 8-bit slots and six 16-bit slots. On the review system, three of these were filled with an ARC 16-bit VGA card, an Ultrastor ESDI disk controller, and an ARC parallel/serial board. Two more slots were taken up with the parallel port and second serial port, both of which connect to the parallel/serial board by ribbon cable. The system needs a separate cutout for each port, because they all use DB-25 connectors. This is an avoidable waste of two slots, since the ARC tower has eight additional DB-25-size cutouts. Alternative connectors are available on request for no extra charge; if you buy the Skyscraper, be sure to ask for them.

ARC 386s/25c Skyscraper
American Research Corp., 1101 Monterey Pass Rd., Monterey Park, CA 91754; (800) 423-3877 (outside Calif.), (213) 265-0835.
List Price: With 1MB RAM, 1.2MB 5.25-inch floppy disk drive, one parallel and two serial ports, DOS 3.3 or 4.01, $2,182; with 4MB RAM, 150MB hard disk, VGA monitor, $4,300; with 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, *Microsoft Windows 386* 2.01, mouse, $4,616.
In Short: The Skyscraper tower's low price is offset by generally below-average scores on PC Labs' benchmark tests. The system has good expansion potential, but its design presents some minor inconveniences.

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You can mount as many as five drives in the Skyscraper. The front panel has room for two 3.5-inch half-height and two 5.25-inch half-height devices. There's also room for a hard disk inside, up to a 5.25-inch full-height model, though it's hard to reach because the disk has to be mounted through a cutout in the top of the chassis. You should note that the top bay is intended for one drive only, though it can handle either a half-height or full-height drive. In the tested system, the 150MB Toshiba full-height drive was mounted in the top bay.

The Skyscraper case is unusual in that it is held together with only two screws. The front-panel cover is held on with strong spring-loaded clips, like the hubcap on a car. To open the system, you pop the cover off, remove the two screws to release the top, slide the top off, and then lift off the side panel, which is simply hooked on the chassis.

This arrangement is a mixed blessing. The minimal number of screws makes it

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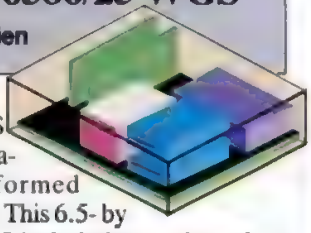
easy to open the system. But the front-panel cover is difficult to snap back on without some pounding, much as with a hubcap. And you ought to feel uneasy about hammering on the front panel of a computer—especially if you have some valuable data on the hard disk inside. ARC acknowledges that most people will reinstall the front panel by hitting it, but adds that the case has been available for three years without causing problems.

All told, the ARC 386s/25c Skyscraper is a credible system but mildly flawed. There is nothing seriously wrong with it but nothing particularly enticing either. If you can get it at a low enough price, the Skyscraper may be worth considering.

AT&T COMPUTER SYSTEMS

AT&T 6386/25 WGS

by Bill O'Brien



AT&T's 6386/25 WGS is a fine testament to reformed conservatism. This 6.5- by 21.25- by 18.5-inch desktop unit marks a departure from the flat, square surfaces of earlier AT&T computers and might almost be considered a tribute to the Frank Lloyd Wright school of architecture. The $9,804 list price, however, is certain to raise questions as to what's behind the facade. But since the machine is available through dealer channels, you may be able to find it discounted, and if you purchase it for use as a workgroup system (implied by the WGS in its name), its price seems more in line.

Raise the cover on the 6386/25 WGS carefully. It is one of the heaviest you will ever find. It is obvious that AT&T is serious in its concern about radio-frequency interference and maintaining its FCC Class B certification; to that end, it has applied enough shielding inside the cover to thwart even the most determined spurious emissions. Beyond this point, the real estate becomes as familiar as in any IBM-alternative computer.

Like its 33-MHz cousin, this 25-MHz 80386 computer relies on an Intel motherboard for its platform. The most noticeable feature of this arrangement is the high count of discrete components and the near absence of VLSI chips. Even the Intel 80385 cache controller is absent, although

AT&T 6386/25 WGS
AT&T Computer Systems, 1776 on the Green, Morristown, NJ 07962, (800) 247-1212.
List Price: With 4MB RAM, 135MB hard disk, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, VGA monitor, one parallel and two serial ports, DOS 4.01, $9,804.
In Short: Although this is essentially an Intel computer, AT&T did not cut corners by having another company build parts of its PC. The relatively high ticket price places this model out of the range of the individual user, but it is intended as a workgroup server, and it should have sufficient corporate appeal.

CIRCLE 423 ON READER SERVICE CARD

the 6386/25 WGS submitted for review did come with 64K of 35-nanosecond static RAM as processor RAM cache. Controller duties are handled by an array of discrete chips rather than the more popular and reliable single controller.

Memory expansion is handled through AT&T's 4/16MB Memory Expansion Boards, which can boost the system total to 32MB maximum. The system includes 4MB of dynamic RAM standard, and the extremely fast processor RAM cache permits a zero-wait-state fast page arrangement for the system memory despite the 100-ns. chip rating. Thanks to this Intel design, the benchmark test results for the processor and RAM sections of the computer are relatively fast. While this is certainly no screamer, its performance is quite commendable.

Also standard with the base model is an ESDI 1:1-interleaved disk controller. Five half-height disk drives can be comfortably installed in the 6386/25 WGS, and the reviewed unit arrived with a full-height hard disk and two half-height floppy disk drives. The remaining vacant half-height bay is an ideal home for a tape drive. The 6386/25 WGS we tested included an ESDI controller coupled to a 135MB (formatted) Maxtor drive, and the combination performed respectably on PC Labs' disk benchmark tests. Both the large- and small-record test results place the 6386/25 WGS smack in the middle of the field, even though it lacks any hardware or software disk caching.

The 6386/25 WGS excels in its keyboard and video system. Keyboard response is outstanding, with limited tactile and audio feedback and a pleasing, neutral feel. The user can choose one of several video systems with the standard model, and the benchmark test results report the performance of a VGA system. Although the video can be shadowed for faster response, our video benchmark tests are performed with all shadowing turned off. Even so, the Western Digital video card (directed by a Paradise VGA chip) produced extremely fast results when we addressed the card directly, as many programs that run in a DOS environment would do. But neither of the Video BIOS Routine tests resulted in flattering speeds. Visually, the video system showed no faults whatsoever.

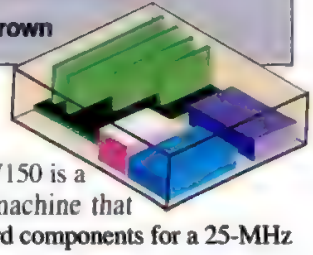
The 6386/25 WGS has a mouse connector, permitting you to use the parallel port and dual serial ports for other devices. And the owner's manual should become an industry standard for clarity and content.

For the individual user, it's difficult to recommend the AT&T 6386/25 WGS. In the corporate market, where brand assurance is a factor, AT&T becomes competitive with its rivals, IBM and Compaq, particularly when the computer is used as a network server. At that level the 6386/25 WGS becomes an honest contender for your buying dollars.

BLACKSHIP COMPUTER SYSTEMS INC.

Blackship BLK386/25V150

by Bruce Brown



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desktop unit and average performance. Its $4,120 price is about $200 to $600 higher than some similarly equipped machines, including the Pan United PC 386/25 Cache and the Myoda MD7240. Yet it actually seems a good value when compared with some of the costlier products in this roundup.

The standard configuration is outfitted with 4MB RAM and 32K RAM cache, a 120MB 28-millisecond Seagate ST4144 RLL hard disk, a 1.2MB floppy disk drive, Western Digital floppy/hard disk controller, 16-bit VGA adapter with color VGA monitor, one parallel and two serial ports, 101-key Key Tronic keyboard, and DOS 4.01. Our test unit included a 150MB hard disk and Intel 80387-25 math coprocessor, which raised the price to $4,984. So equipped, the Blackship is a powerful albeit pricey computer.

On PC Labs' benchmark tests, the BLK386/25V150 displayed performance that was about average compared with other cache-equipped machines. The processor-based test scores were average; the memory was faster than that, and the disk drive scores marginally better than the norm, while some of the video timings dipped way below the average mark. There's no cause for complaint here unless you're using heavy graphics applications. In that case, you should specify a faster video card than the Orchid Pro Designer VGA that came in the test unit.

The Blackship BLK386/25V150 comes with a seven-day money-back guarantee, starting from the day you receive the machine.

The BLK386/25V150's desktop case measures 6.25 by 23 by 16.5 inches. From the front you can see three drive bays, keylock and turbo and reset switches, and lights for power, turbo mode, and hard disk access.

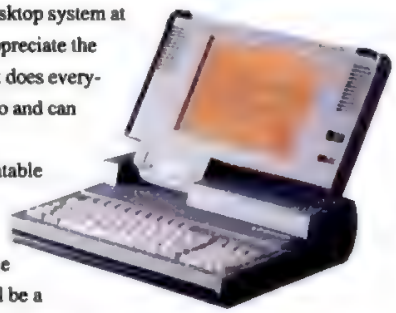
The base components include a Micronics motherboard with a Chips and Technologies 386 chip set and an Intel 82385 RAM cache controller. You can expand the cache from the standard 32K up to 64K, but you probably wouldn't see that much of a performance improvement. Blackship refers to the BLK386/25V150 as a zero-wait-state machine and reports a 95.8 percent cache hit rate, which represents a very respectable amount of time to be operating truly at zero wait states. The machine uses a Phoenix ROM BIOS, Version 1.10 10A, with its setup in ROM along with selectable system and video ROM shadowing.

All of the system's RAM is on a Micronics memory card, which occupies the sole 32-bit slot on the machine. The test unit came with 80-nanosecond 256-kilobit DIP chips, but you could use 1-megabit chips instead and increase the total to 16MB of system RAM.

You can use the computer's five half-height drive bays for any combination of full-height and half-height drives. The

Top of the Line Quality at a Value Price

When you are away from the desktop system at your home or office, you will appreciate the features of the **LT5400** laptop.It does everything a desktop computer can do and can also link with a modem.



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	TOPPCS LT5400	COMPAQ SLT/286	NEC 386 ProSpeed CSX	TOSHIBA T3200SX	ZENITH Super Sport SX
CPU	80386SX-16	80C286-12	80386SX-16	80386SX-16	80386SX-16
RAM(STD/MAX)	1/4 MB	640 KB/3.6 MB	2/4 MB	1/13 MB	1/8 MB
DISPLAY	Gas Plasma/VGA	LCD/VGA	LCD/VGA	Gas Plasma/VGA	LCD/VGA
RESOLUTION	640*480	640*480	640*400	640*480	640*480
KEYBOARD KEYS	85 (detachable)	81	89	91	79
KB/KEYPAD FIRST	Yes	Yes	N/A	Yes	Yes
3.5" FDD	1.44 MB	1.44 MB	1.44 MB	1.44 MB	1.44 MB
HDD	40 MB	40 MB	40 MB	40 MB	40 MB
SERIAL-PORT	2	1	1	2	1
PARALLEL-PORT	1	1	1	1	1
VGA-PORT	Yes	Yes	Yes	Yes	Yes
EXT-FDD PORT	5.25"	5.25"	5.25"	5.25"	5.25"
I/O EXP-SLOT	2	2	2	(6)	3
SIMULTANEOUS INT/EXT DISPLAY	Yes	No	No	Yes	No
SEPARATE FDD/PRINTER PORTS	Yes	No	No	No	No
WARRANTY	18 Months	12 Months	12 Months	12 Months	12 Months
LIST PRICE	$5,000	$5,999	$8,499	$6,299	$6,799

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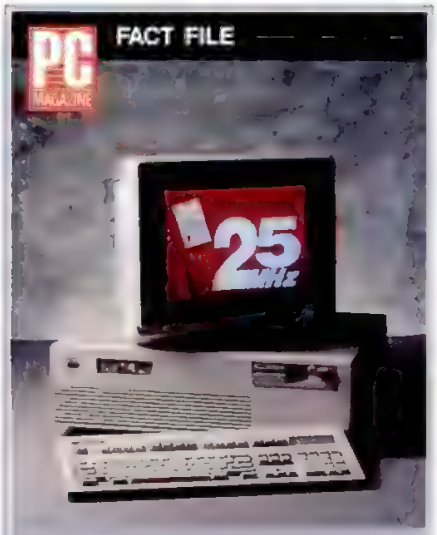
230-watt power supply, 30 watts more than usual, includes four power leads for disk or tape drives. The motherboard contains two 8-bit and five 16-bit slots in addition to the 32-bit memory slot. Four slots were unused in our test machine.

Blackship sells directly to end users only. The BLK386/25V150 comes with a seven-day money-back guarantee, starting from the day you receive the machine. Blackship charges flat rates for shipping in the continental United States. In addition to the computer's guarantee, you get a one-year parts-and-labor warranty but no on-site service contract. If you can't diagnose and fix a problem with the help of the toll-free technical support number, you have to ship the machine back to the facility in Fremont, California, for repair and pay for the shipping one way. Blackship promises 24-hour turnaround on the machines received for service work.

Overall, the Blackship BLK386/25V150 offers few surprises either good or bad. It performs adequately and is composed of brand-name parts. The cost is a little high, and the computer would be more competitive if an on-site service contract were standard, but otherwise this is a typical AT-style 386 machine.



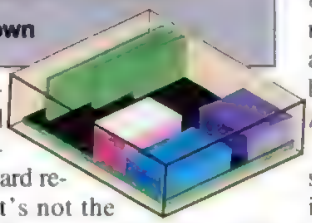
Blackship BLK386/25V150
Blackship Computer Systems Inc., 4031 Clipper Ct., Fremont, CA 94538; (800) 877-6249, (415) 770-9300
List Price: With 1MB RAM, 1.2MB 5.25-inch floppy disk drive, one parallel and two serial ports, $2,195; with 4MB RAM, 120MB hard disk, VGA monitor, DOS 4.01, $4,120; with 150MB hard disk, $4,395.
In Short: The Blackship BLK386/25V150 is a full-sized desktop unit with average performance for its class. For a mail-order machine, the price is slightly higher than average, and the service and support mix is not really competitive.

CIRCLE 424 ON READER SERVICE CARD

CLUB AMERICAN TECHNOLOGIES INC.

Club Model 325Ci

by Bruce Brown



Standard components mixed together generally yield standard results. But that's not the case with the Club Model 325Ci. Club American Technologies has combined the usual 25-MHz 80386 components with its own slightly tweaked motherboard to produce a system that performs significantly better than many of its competitors.

At $4,060, the Club Model 325Ci includes 4MB RAM and a 64K RAM cache, 150MB 14-millisecond ESDI hard disk, 1.2MB floppy disk drive, floppy/hard disk controller, one parallel and two serial ports, Everex Viewpoint 16-bit VGA card and color VGA monitor, 101-key Key Tronic keyboard, and DOS 3.3. We tested almost the same configuration, except our test machine had just one serial port.

The 325Ci comes in a standard AT-style desktop case, 6.5 by 21 by 16.5 inches. Three drive bays for removable media can be seen from the front, along with the case lock, a flush-mount reset switch and turbo switch, and the normal complement of power, turbo, and hard disk access lights.

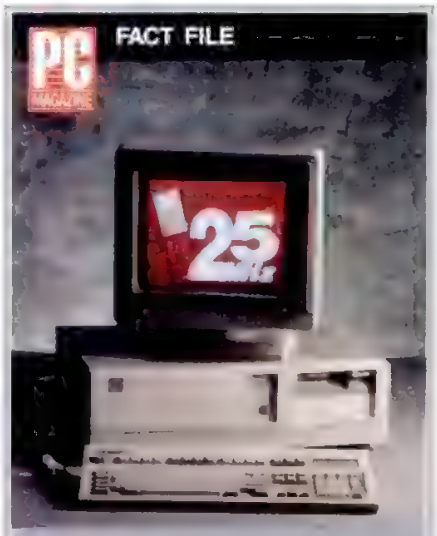
The machine scored high on our benchmark tests. It had the fastest overall processor scores and was tied for the second-quickest Conventional Memory scores. The video timings all rated above average, as did the results for the BIOS Disk Seek and large-record DOS File Access tests. The 325Ci slipped only on the small-record DOS File Access test, scoring in the lower third of the group.

The Club AT motherboard uses an Intel chip set for 386 instructions and discrete logic for control of the RAM cache. It provides space for only one math coprocessor chip; you can fill it with an Intel 80387-25 or a Weitek 1167 or 3167. You can expand the on-board cache all the way to 256K, although the standard 64K of 35-nanosecond chips works just fine. With just the 64K cache installed, the zero-wait-state effective hit rate runs at a decent 93 percent. The standard ROM BIOS is from AMI, with the setup in ROM and shadowing selectable for both system and video ROM.

Memory for the 325Ci starts on the motherboard; you can expand it to 8MB using 1MB 100-ns. SIMMs. If you want more RAM, the single 32-bit slot will take an Everex memory board for an additional 8MB. This computer, by the way, is not a relabeled Everex machine. Club AT owns an OEM company that sells Everex 286s, but its 386 machines are made to Club AT's own specifications.

Expansion slots include one 8-bit slot, six 16-bit slots, and one 32-bit slot that is intended only for the optional memory board. In our tested machine, five of the slots were unused. You can fill the machine with five half-height disk or tape drives, and the 200-watt power supply includes four power leads to be used for storage devices.

Club AT sells both directly to customers and through dealers. The company offers no standard on-site service arrangement, but the one-year warranty is backed by a technical support line. If you have a problem with a machine that can't be resolved by telephone, you return the computer either to the manufacturer or to the dealer, depending on where you bought



Club Model 325CI
Club American Technologies Inc., 3401 West Warren Ave., Fremont, CA 94539; (415) 683-6600.
List Price: With 1MB RAM, 1.2MB 5.25-inch floppy disk drive, one parallel and one serial port, $1,985; with 4MB RAM, 150MB hard disk, VGA monitor, DOS 3.3, $4,040; with two serial ports, $4,060.
In Short: This desktop unit (with caching) is a good deal, performing significantly above average on our benchmark tests. Compared with what other mail-order houses offer, the price on this component mix is average, as are the service and support.

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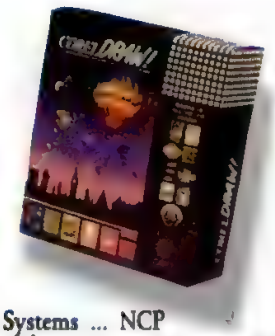

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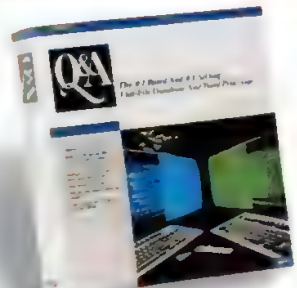

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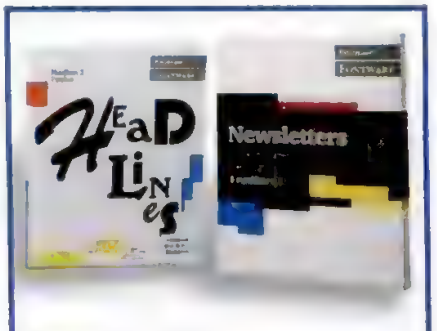

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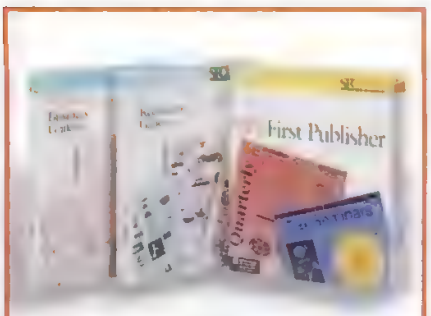

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5851 ▣SimCity ..... 33.

Electronic Arts ... NCP
6436 ▣Hunt for Red October ..... 20.
4659 ▣Chessmaster 2100 *(CP)* ..... 35.
5804 ▣Deluxe Paint II *(Enhanced)* ..... 89.

Microsoft ... NCP
2858 ☐Flight Simulator 4.0 ..... 39.

Parlor Software ... CP
3159 ☐Bridge Parlor 2.3 ..... 49.

Penton Overseas ... NCP
▣VocabuLearn/ce Levels I & II (French, Italian, German, Spanish, Russian, and Hebrew) ..... *each* 39.

Sierra On-Line ... CP
6023 ▣Leisure Suit Larry III ..... 39.
6796 ▣Codename: Iceman ..... 39.
6972 ▣Conquests of Camelot ..... 39.

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6675 ☐ *Network Bundle for DOS 3.0*—Allows you to quickly and easily share files, electronic mail, and printers between your Apple Macintosh, IBM PC and/or Sun Workstation. Now includes Inbox EMail software . $159.

Spectrum Holobyte ... NCP
5993 ▣Welltris ..... 22.

Stone & Assoc. ... NCP
3438 ▣Young Math *(ages 5 to 8)* ..... 22.
3439 ☐2nd Math *(ages 7 to 16)* ..... 27.

True BASIC, Inc. ... NCP
▣Kemeny/Kurtz Math Series: 10 titles ..... *each* 45.

HARDWARE

Manufacturer's standard limited warranty period for items shown is listed after each company name. Some products in their line may have different warranty periods.

American Power ... 2 years
6812 200DL *(stand-by power source)* .. 155.
6811 360SX *(stand-by power source)* ... 255.
7107 450AT *(stand-by power source)* ... 339.
7106 520ES *(stand-by power source)* ... 399.
7105 600LS *(stand-by power source)* ... 469.

MECA ... NCP
7002 ▣ *Home Lawyer 1.0*—Let Hyatt Legal Services help you through the legalese by using plain English. Contains 16 commonly used documents and guides you step-by-step through each one ..... $69.

AST Research ... 2 years
1299 SixPakPlus 384k C/S/P ..... 187.
6795 SixPak 286 512k ..... 209.
4107 RAMpage Plus 286 512k ..... 419.
6980 VGA Plus *(w/512K) (800 x 600 res)* 159.

Boca Research ... 5 years
7001 BOCARAM/AT PLUS *(0-8 Meg ext.)* 125.
7000 TophAT *(16-bit backfill 512K to 640K, with 0K)* ..... 79.
6998 I/O Board for AT ..... 59.
6999 I/O Board for Microchannel S/S/P . 109.

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5787 HL-8e Laser Printer ..... 1799.
5788 HL-8Ps PostScript Laser Printer . 2949.

Compucable ... 2 years
1604 2-Position switch box ..... 25.

Cuesta ... 1 year
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Curtis ... lifetime
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Datadesk ... 3 years
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1904 FX-1050 *(136 col., 264 cps, 9 pin)* .. call
5183 LQ-510 *(80 col., 180 cps, 24 pin)* ... call
1930 LQ-850 *(80 col., 264 cps, 24 pin)* .. call
6765 LQ-1010 *(136 col., 180 cps, 24 pin)* call
1917 LQ-1050 *(136 col., 264 cps, 24 pin)* call
4116 LQ-2550 *(136 col., 333 cps, 24 pin)* call
5184 LX-810 *(80 col., 180 cps, 9 pin)* .... call
1052 Printer-to-IBM cable *(6 feet)* ..... 15.

5th Generation ... 1 year
7157 Logical Connection Plus 512k .... 599.

Hayes ... 2 years
2307 Smartmodem 2400 ..... 349.
2308 Smartmodem 2400B *(w/Smartcom II)* 279.

Hercules ... 2 years
2318 Graphics Card Plus ..... 189.

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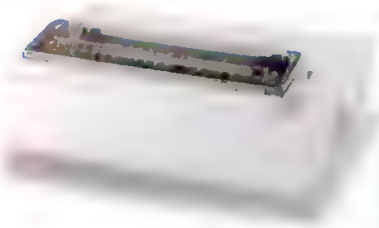

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5183 *LQ-510 Printer*–Makes high quality 24 pin printing affordable. Includes push tractor and Epson's exclusive SmartPark paper handling features standard. 180 cps draft, 60 cps LQ (12 cpi mode)..... call

Hewlett-Packard ... 1 year
6754 LaserJet III *(w/toner)* ..... 1699.
6582 LaserJet IIP *(w/toner)* ..... 1069.

Intel ... 5 years
6421 2400B MNP Internal Modem .... 199.
2352 2400B Internal Modem 2 *(for PS/2)* 249.
5119 2400 Baud External Modem ..... 179.
6420 2400EX MNP Modem..... 229.
2346 Inboard 386/PC w/1 Meg *(w/free Ami)* 519.
4266 Above Board Plus 512k ..... 419.
4267 Above Board Plus I/O 512k ..... 449.
5336 Above Board Plus 8 2 Meg ..... 599.
5342 Above Board Plus 8 I/O 2 Meg ... 629.
4272 Above Board 2 Plus 512k ..... 169.
5396 Above Board MC 32 0k ..... 359.
4275 Connection CoProcessor *(w/Fax-it)*. 529.
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2370 80287-8 *(for 8 MHz 80286 CPU's)* . 199.
2369 80287-10 *(for PS/2 Models 50 & 60)* 229.
4750 80387SX *(for 80386SX CPU's)*.... 309.
2371 80387 *(for 16 MHz 80386 CPU's)* .. 349.
2372 80387-20 *(for 20 MHz 80386 CPU's)* 399.

Kensington Microware ... 1 year
2582 Master Piece Plus ..... 109.
5697 Expert Mouse *(Trackball for PS/2)* . 115.

Key tronic ... 3 years
4518 101 Plus Keyboard ..... 99.

Kraft ... 5 years
5801 New Game Adapter *(2 game ports)*. 27.
5800 3 button Thunder Joystick..... 29.
5802 Trackball..... 69.

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5464 C9 Mouse for PS/2's..... 69.
5151 HiREZ Mouse *(C9)* ..... 85.
6029 Trackman *(Trackball) serial* 85. *bus* 89.
4297 ScanMan Plus *(hand scanner)* ... 185.
6786 ScanMan w/Catchword 1.0..... 315.

Micron Technology ... 2 years
6669 Intensify 2 Meg Expansion for HP LaserJet II *(upgradeable to 4 Meg)*. 329.
6013 Beyond Mem. Brd. for Model 50 *(512k)* 359.

Microsoft ... lifetime
2897 Mouse with Paintbrush ..... 109.
2898 Mouse with Windows 3.0 ..... 149.

MicroSpeed ... 1 year
6007 PC-TRAC Trackball *serial* $75. *bus* $85.
6010 FastTRAP 3D Trackball *serial* 99. *bus* 109.

Mouse Systems ... lifetime
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4306 PC Mouse II w/PC Paint+ ..... 89.

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6208 Multisync 4D Monitor..... 1199.

Orchid Technologies ... 4 years
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3100 1200 Baud External Modem *(mini)* . 77.
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3102 2400 Baud External Modem ..... 179.
5286 2400 Baud Int. MNP Modem *(Lev. 5)* 175.
5285 2400 Baud Ext. MNP Modem *(Lev. 5)* 209.
4542 2400 Baud Internal Modem for PS/2 . 229.

Reflection Technology .. 1 year
7127 Private Eye *(visual display)* ..... 499.

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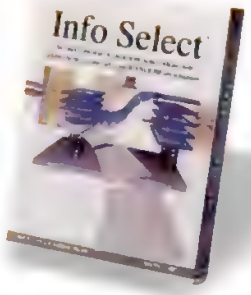

Micro Logic ... NCP
6787 ▣*Info Select 1.1*–The fastest most exciting new way to deal with notes, ideas, plans, contacts, and all your RANDOM information. Easy yet powerful. Endless uses . $55.

SAFE Power Systems ... 2 years
4562 Safe 425W *(standby power bkup)* 329.
6747 Safe 400S..... 409.

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5111 SOTA 286i-12 *(12 MHz accelerator)* 269.
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Targus ... lifetime
7028 Foliopac 1..... 79.
4899 Nylon Laptop carrying case ..... 55.
6037 Premier leather carrying case .... 199.

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5598 TheComplete Half Pg. Scanner 400 189.
5140 TheComplete Page Scanner..... 549.
5828 TheComplete Communicator ..... 559.

Tripp Lite ... 2 years
6199 Isobar 4-6 *(4 outlets, 6 ft. cord)* .... 49.
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6019 LS 600 Line Stabilizer ..... 85.

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5117 Bernoulli II Dual 44 Meg External 1969.
5113 44 Meg Cartridge Tripak *(5¼")* . . . 249.
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Mountain Computer ... 1 year
2917 40-60 Meg Internal Tape Drive. . . . 379.
5502 83-152M Ext. Tape Drive. . . . . 799.
5500 83-152M Int. Tape Drive . . . . . 629.
5190 DC2000 Pre-formatted Cartridges ea. 35.

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6602 1.44 External *(for PC/XT/AT)* . . . . . 239.

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7029 Folopac 2
(with optional A.C. adaptor pocket) . . . . . 85.

3½" 20 Meg Int. Hard Drive ST125-1 (28 ms) *(w/controller, cables, mounting equip. for PS/2 Model 25 or 30 or PC/XT - specify computer)* . . . . . 339.
2286 30 Meg Int. Hard Drive ST238 *(w/controller and cables, 65 ms)* . . 289.
4554 40 Meg Int. HD ST251-1 (28 ms) . . 359.

TEAC ... 1 year
4951 720k Drive *(specify XT or AT, 3½")* . 79.
4670 1.44 Meg Drive for XT *(3½")*. . . . . 99.
4326 1.44 Meg Drive for AT *(includes Bastech software utilities, 3½" copy prot.)* . 119.

MISCELLANEOUS

Checkfree
6360 CheckFree . . . . . 25.

CompuServe
1676 CompuServe Information Service . $24.

Cables ... lifetime
1019 Smartmodem-to-AT cable *(10 feet)* . 15.
5511 Right Angle Printer cable *(6 feet)* . . . 15.
1050 Parallel Printer cable *(15 feet)* . . . . . 19.

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Maxell ... lifetime
2789 5¼" MD2-D 360k Disks *(Qty. 10)* . . . . 12.
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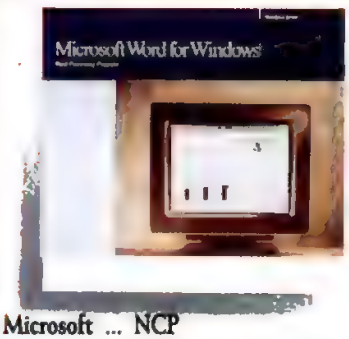
7127 Private Eye—A large screen in a small box. A tiny virtual display which offers a full-size, 12" IBM CGA auxiliary screen to PCs & laptops. View privately in planes or meetings. Brighter than LCDs. Great for games! $499.



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2792 3½" DS/DD 720k Diskettes *(Qty. 10)* . . 14.
2793 3½" DS/HD 1.44Mb Diskettes *(Qty. 10)* 27.

Sony ... lifetime
3291 5¼" DS/DD 360k Disks *(Qty. 10)* . . . . 10.
3292 5¼" DS/HD 1.2Mb Disks *(Qty. 10)* . . . 19.
3297 3½" DS/DD 720k Diskettes *(Qty. 10)* . . 13.
3298 3½" DS/HD 1.44Mb Diskettes *(Qty. 10)* 22.
6659 QD 2000 Tape Cartridge . . . . . 19.

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3248 256k DRAMs *(120 nanosecond)*. . . call
4366 1 Meg x 9 SIMMs *(100 nanosecond)* call
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6922 ☐ *MultiMate 3.31*—Upgrade to MultiMate 4.0 through Ashton-Tate for $79.50. Total cost $151.50 including shipping. Save over $400 on list price of $565. Call for details . . . . . $69.

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- For monitors, printers, Bernoulli Boxes, computers, hard drives, and power backups, actual UPS Blue charge will be added. For all other items, add $3 per order.

Alaska and outside Continental US:
- Call 603/446-7721 for information.

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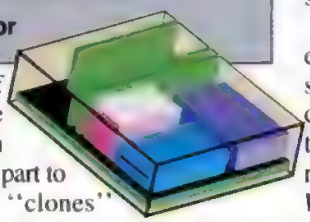
the unit. There is a 30-day money-back guarantee; UPS charges are calculated for the actual cost of each shipment, which is often a better deal than other vendors' flat fees. Unfortunately, Club AT adds a surcharge for all credit cards: 3 percent for Visa and MasterCard, 4 percent for American Express.

Compared with 25-MHz 386s from other mail-order vendors, the Club Model 325Ci performs excellently; and it's available at a price that seems to be about average for mail order, even though Club AT's machines are also available through dealers. For direct purchases from Club AT, it would be better if on-site service were included and no Visa or MasterCard surcharges were passed along to the customer, but you can't have everything. If you need an especially fast 25-MHz 386, this computer is worth a close look.

COMPUADD CORP.

CompuAdd 325

by Alfred Poor



The success of PC-compatible computers can be attributed in part to the success of "clones" marketed directly to buyers through mail-order sales. Among a handful of manufacturers that have established solid and well-known reputations, CompuAdd Corp. stands out as one of the best. And the CompuAdd 325 is a good example of the type of product that has kept the company going while others have disappeared in the night.

This 25-MHz 386 desktop system carries a list price of $3,742 for our standard configuration of 4MB RAM, 110MB hard disk, and color VGA. CompuAdd's price may not be the lowest in the field, but it's still aggressive. There are no cut corners here, either. The standard AT-style case is solidly built out of heavy-duty metal with excellent fit and finish.

The system memory consists of 1MB SIMMs on a proprietary 32-bit memory card. Our test unit came with 4MB installed, and there was room for up to 16MB. The motherboard carries 32K of static RAM as a system memory cache driven by an Austek cache controller, which boosts system performance.

CompuAdd has taken a middle path between putting features on the motherboard and relying on expansion cards. For example, you need cards for your floppy disk controller and display adapter, but the motherboard includes an IDE hard disk interface, a parallel port, and two serial ports. The first serial port is unusual in that it has both 9-pin and 25-pin connectors. All of the motherboard's features can be disabled if you have expansion cards that duplicate or replace its functions; for example, our test unit had a separate floppy/hard disk controller.

The CompuAdd 325 performed excellently on our hard disk benchmark tests and not so well on the microprocessor tests. Timings on the Video BIOS Routine tests were also notably slow.

The system comes with some of the most comprehensive and useful documentation on the market. Each component merits a separate pamphlet, but all the manuals have been produced specifically for CompuAdd. All are clearly written and designed to fit together neatly in the oversized binder and slipcase.

The biggest news, however, is all the extras you get with this computer. Many systems makers bundle DOS and maybe a disk caching program and some diagnostics; CompuAdd does. A few have announced that they will include *Microsoft Windows*, Version 3; CompuAdd will. But few manufacturers would do what CompuAdd does: it takes DOS and *Windows* and installs them on your system's hard disk, configuring everything so that it will run right out of the box. You just plug it in and get to work!

Of course, you can beef up your system with any of a zillion choices for hard disks, displays, and other options. Our evaluation unit came with CompuAdd's HardCache ESDI caching disk controller. CompuAdd also has announced a new, low-cost, high-performance VGA adapter that will produce 1,024 by 768 (interlaced) images. And your system will be backed by a full year of on-site warranty service with Memorex Telex.

CompuAdd has one more major advantage over most of its competitors. As with the others, you can call a toll-free number to place your order. Unlike other companies, however, CompuAdd has embarked on an ambitious experiment; there are now CompuAdd stores in many locations throughout the country that offer the same prices as the mail-order service but give you a chance to look at the equipment while you ask questions and make up your mind.

And you get all of this at competitive prices: solid construction, adequate performance, superior documentation, outstanding extras, and nearly unlimited options. The CompuAdd 325 deserves a spot on anyone's evaluation list.

FACT FILE

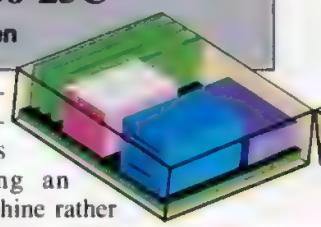
CompuAdd 325
CompuAdd Corp., 12303 Technology Blvd., Austin, TX 78727; (800) 627-1967, (512) 250-1489.
List Price: With 1MB RAM, 40MB hard disk, 1.2MB 5.25-inch floppy disk drive, one parallel and two serial ports, monochrome VGA monitor, DOS 4.01, *Microsoft Windows*, $3,195; with 4MB RAM, 110MB hard disk, 1.2MB 5.25-inch floppy disk drive, color VGA monitor, $4,388; with 150MB hard disk, $5,273.
In Short: CompuAdd has a winning combination of price, features, and support. While some other computers cost less, this one might well represent the best value in its class.

CIRCLE 426 ON READER SERVICE CARD

COMPUTER MARKET PLACE INC.

Ultra 386-25C

by Bill O'Brien



A standing argument concerns the merits of purchasing an 80386SX machine rather than a more flexible 80386 model. When considerations of price enter the debate, the SX typically wins out with its lower bottom-line figure. Computer Market Place has just thrown a wrench into the works. Its desktop Ultra 386-25C comes in at a pauper's price of $2,896.

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PC MAGAZINE EDITORS' CHOICE April 24 1990 Pizazz Plus

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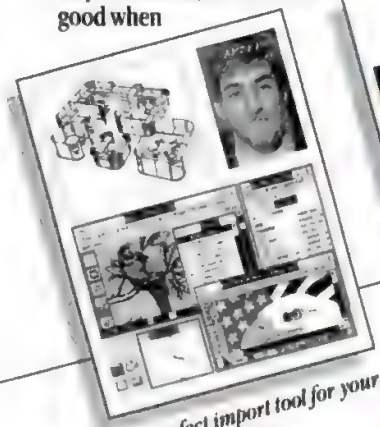

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CIRCLE 386 ON READER SERVICE CARD

the punching power a machine with such a small price tag can pack, be advised that the Ultra 386-25C that arrived at PC Labs included 8MB of 80-nanosecond RAM, a 120MB RLL hard disk, and 32K of processor RAM cache. That's a power configuration, with more RAM for the dollar than any of the other systems reviewed here. It is backed up by a VGA display system with a card and monitor both capable of handling extended 1,024 by 768 resolution. DOS 4.01 and *PC-Kwik* were part of the package as well.

A basic-configuration 25-MHz system that brings you 1MB of RAM, a 40MB hard disk, a Hercules-compatible monochrome display system with a flat-screen 14-inch monitor, and DOS 4.01 tips the price scales at an unreal $1,822.

Ultra 386-25C
Computer Market Place Inc., 450 Parkway, #202, Broomall, PA 19008; (800) 545-7397.
List Price: With 1MB RAM, 40MB hard disk, 1.2MB 5.25-inch floppy disk drive, monochrome monitor, one parallel and two serial ports, $1,822; with 4MB RAM, 100MB hard disk, VGA monitor, DOS 3.3 or 4.01, $2,896; with 8MB RAM, 120MB hard disk, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, *PC-Kwik*, $3,457.
In Short: Computer Market Place provides a unit completely tailored to your specifications. The pricing is low enough, but price and performance are closely linked.

CIRCLE 427 ON READER SERVICE CARD

There is a catch. In most cases, brand names mean nothing at Computer Market Place. The motherboard in the reviewed machine is from Laser Digital. The BIOS is from Award, with a Chips and Technologies 80386 chip set. And the hard disk is a Seagate model 4144R with an Adaptec 2372 RLL controller. On the other hand, the Ztech Electronic Corp. may not be a familiar name to you, but it's the creator of the ZPVGA video card the Ultra 386-25 uses. Nor would calling the monitor an Aamazing CM8484E Ultra VGA.28 Color Monitor necessarily clue you in that the brand is Aamazing.

Should brand names count? The off-brand video system posted some of the fastest results when tested under PC Labs' video benchmark tests, showing favorable times for both BIOS calls and direct hardware writes. Conversely, the more popular Adaptec/Seagate hard disk combination produced some lackluster times on our disk benchmark tests. While the RLL drive system is faster than the basic-configuration Ultra's 40MB MFM drive because of RLL's larger number of tracks per sector, the Seagate 4144R included is a slow 30-millisecond drive that befits the overall low system price.

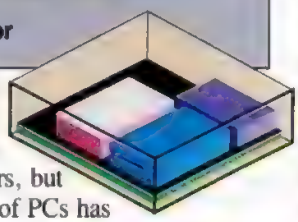
Continuing the pattern of adherence to a realistic price/performance ratio, even the 25-ns. cache RAM couldn't provide enough leverage to yank the Ultra 386-25C to the top of the pack for the processor benchmark test results. But its scores are in the same respectable region where you'll find IBM's PS/2 Model 80-A31, weighing in at several times the price.

Of course, you don't have to spend just a little money with Computer Market Place. You can spend a lot. The machine you buy may bear no resemblance at all to the one reviewed. The exact specifications are solely your choice. Computer Market Place offers to customize a machine all the way down to the motherboard and BIOS level based on the products you request. So if you ever thought that you knew better than most vendors which parts would make the ideal computer, there could well be an Ultra in your future.

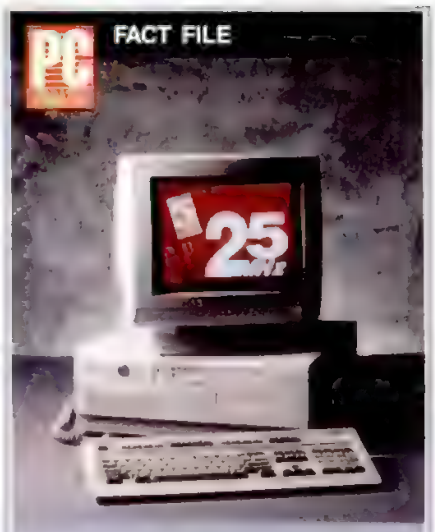
DATA GENERAL CORP.

Dasher/386-25k

by Alfred Poor



Data General Corp. is well known for its larger computers, but its Dasher line of PCs has never achieved much fame in the PC-compatible marketplace. The Dasher/386-25k is a brand-new design with a list price of $5,690 that stands a chance to change Data General's reputation.



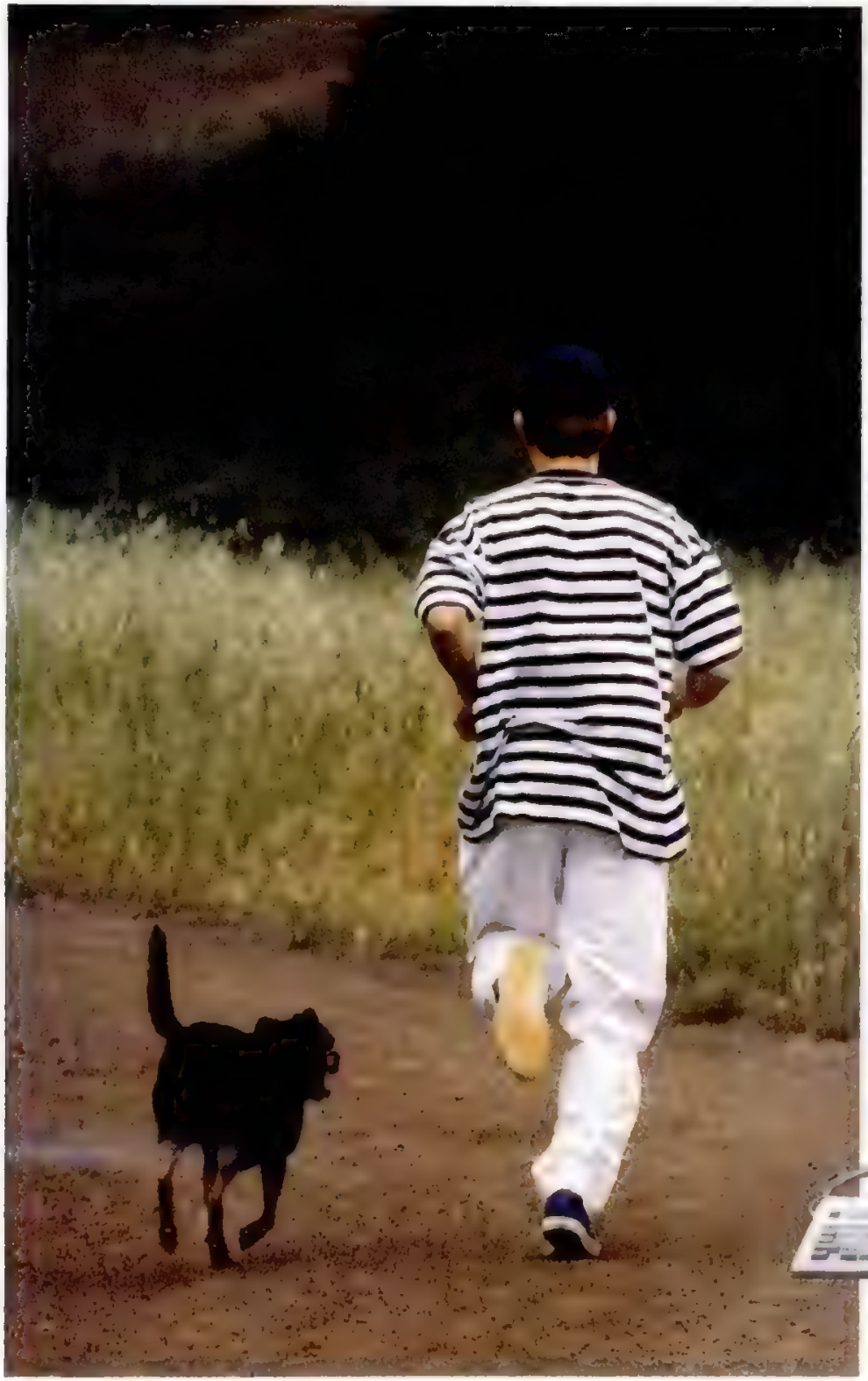
Dasher/386-25k
Data General Corp., 4400 Computer Dr., Westboro, MA 01580; (800) 328-2436.
List Price: 4MB RAM, 40MB hard disk, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, VGA monitor, one parallel and two serial ports, DOS 4.01, $5,290; with 100MB hard disk, $5,690.
In Short: Inside its small-footprint package, the powerful Dasher/386-25k offers the same expansion potential as most full-sized systems, since it incorporates many features on its motherboard.

CIRCLE 428 ON READER SERVICE CARD

The Dasher is a small-footprint machine, and at first you might wonder at a downsized design for a midrange machine. One look under the hood explains the rationale, however. The motherboard has four 16-bit expansion slots, plus another 16-bit connector mounted backwards (it accepts only a proprietary 32-bit memory card). Our evaluation unit included 4MB of RAM, a 100MB hard disk, a 1.44MB floppy disk, a VGA display, and one parallel and two serial ports. Yet with all these features, every expansion slot was still available.

How does Data General accomplish this little feat of magic? All the options are built into the motherboard. There is a VGA adapter based on the Chips and Technologies chip set. The floppy disk controller is on the motherboard, as is the IDE hard disk interface that drives a Conner 100MB 3.5-inch hard disk. Memory, serial ports, and parallel port all are built into the motherboard. This means that you still have four expansion slots left for external peripherals, network cards, bus mouse adapters, and other essential devices that eat expansion slots.

The case is not spacious, but there is room for additional expansion here. There are two bays for 3.5-inch storage devices; the evaluation unit came with both of them



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CIRCLE 519 ON READER SERVICE CARD

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FX-1800MSYSHD	1Mb	1.44Mb	40Mb	VGA	VGA	
FX-1800CSYSHD	1Mb	1.44Mb	40Mb	VGA		VGA
FX-1925S	1Mb	1.44Mb		SVGA		
FX-1925SMSYSHD	1Mb	1.44Mb	40Mb	SVGA	VGA	
FX-1925SCSYSHD	1Mb	1.44Mb	40Mb	SVGA		VGA

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PCI-PC

CIRCLE 122 ON READER SERVICE CARD

filled—a floppy disk drive in one and the hard disk in the other. In addition to these two bays, you get room for a pair of half-height 5.25-inch devices. This means that you can add a 1.2MB floppy disk drive and a tape drive or a CD-ROM player without having to resort to an external housing for one of them.

The Dasher has all the design features you would expect to find in a larger system. The motherboard accepts up to 8MB of SIMM memory, and the optional memory card brings the maximum configuration up to the typical 16MB limit. System memory performance gets a boost from the 32K static RAM cache on the motherboard, driven by an Intel 82385 cache controller. The system relies on a chip set from Chips and Technologies and uses an Award BIOS, which also includes a setup program in ROM.

The design is indeed brand-new, and while we didn't find any operational problems, its overall test performance was on the slow side. Data General may take a while to get everything in place for the machine. We received system documentation at the last minute, and although it was attractive and clear about everything it covered, the information it contained was thin in spots. It was definitely aimed more at the novice user interested in getting the machine started; there was little technical information about the system. The manual would benefit from the addition of a thorough index.

The small-footprint Dasher/386-25k has most of the usual options built into its motherboard.

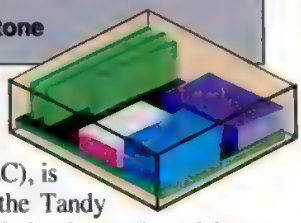
Data General offers this system directly, so you are not likely to find it through some mail-order discount house. But the list price is more than competitive with those from comparable sources, such as AT&T, Compaq, or IBM, and your final price may be a reasonable value.

If you are looking for a powerful system in a relatively small package, then the Dasher/386-25k is worth a look. If you are already a Data General customer, or are thinking about becoming one, here's a good reason to contact the company.

DIGITAL EQUIPMENT CORP.

DECstation 325c

by M. David Stone



The DECstation 325c, from Digital Equipment Corp. (DEC), is a near twin to the Tandy 4025 LX, which is also reviewed here. The resemblance is anything but coincidental. Both systems are products of a cooperative agreement between the two companies, with DEC claiming credit for the design while Tandy handles the manufacturing. But although the machines are similar enough to take advantage of econo-

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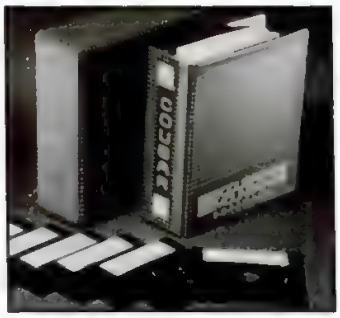

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CIRCLE 194 ON READER SERVICE CARD

25-MHz 386-BASED PCs: SUMMARY OF FEATURES

Standard configuration price For the sake of price comparisons, our configuration includes 4MB RAM, a 100MB hard disk or better, one high-density floppy disk drive, color VGA video display, at least one parallel and two serial ports, a keyboard, and DOS. In some instances, manufacturers do not offer the exact configuration *PC Magazine* requested, but all 23 of the PCs reviewed here provide a reasonably close match for this list of requirements. Check each machine's fact file for a more exact indication of what is included at the quoted price.

Case type indicates whether each computer has a small-footprint, desktop, or tower design.

386 chip set manufacturer indicates which company makes the support logic that connects the CPU with the other functions managed by the system board. Chip sets that employ VLSI (very large-scale integration) technology reduce the discrete component count, which in turn helps to reduce power consumption and increase component life. In some cases the computer uses discrete logic rather than a chip set.

The **system RAM arrangement** is the method in which memory is addressed. Remember that CPU speed is usually faster than conventional memory speed.

Interleaved memory increases processing speed by dividing the memory into two or four portions that process information alternately. The CPU sends information to one section for processing while another section goes through a refresh cycle.

Page-mode memory allows back-to-back memory accesses within blocks of memory called pages, avoiding wait states.

Row/column is the traditional method of accessing data at a memory address. RAM is mapped as a matrix, and a particular address is given using a row and a column number.

In *static-column* memory, once data is located at a specific column address, subsequent pieces of data are accessed or allocated to the same column. Because the column is "static," data retrieval is faster.

Wait states On the average, most machines run at between zero and one wait state. The figures printed here were supplied by the respective manufacturers.

Maximum installable RAM Separate rows indicate the maximum 32-bit memory possible on the motherboard and on a dedicated memory board, as well as the maximum size of the processor RAM cache.

RAM packaging (and rated speed) Memory chips come in a variety of styles: DIPs, SIPs, and SIMMs.

The *dual in-line package (DIP)* is the traditional buglike computer chip sprouting 8, 14, 24, 40, or more metal legs (evenly divided between right and left sides).

Single in-line packages (SIPs) are single-package arrays of computer chip logic assembled so that all connecting legs are in a straight line, like the teeth on a comb. They can be individual chips or multiple chips on a small card, with a proprietary SIP connection. Similar to SIPs are *ZIPs (zig-zag in-line packages)*, in which every other pin connection is slightly offset, creating a zig-zag pattern.

Single in-line memory modules (SIMMs) consist of individual logic devices installed on their own small circuit board, creating a component module that can be plugged into a larger device. Their physical arrangement facilitates easy installation and replacement.

Chip size Kb and Mb refer to kilobits and megabits, respectively. Combination chips (4x256Kb) are generally faster and more expensive.

Processor RAM cache A processor RAM cache acts as a bridge between the CPU and the slower main memory. The cache comprises a small bundle (typically 32K to 128K) of fast SRAM chips. The cache controller is designed to predict and retrieve the data the CPU is likely to require next, thus preventing wait states. There are two varieties of controllers: discrete logic chips (designed by the individual manufacturers) and VLSI chips like the Intel 82385.

The **BIOS version and date** can affect PC Labs' benchmark test results. Those purchasing the same machine with a different BIOS version may encounter some variations in performance.

Setup can reside either on a floppy disk or in ROM.

Shadowing Shadow RAM is a technology that loads system BIOS and/or video BIOS directly into fast RAM on boot-up of the computer, offering enhanced performance speed at the cost of 384K of memory from the first 1MB of system RAM. The ability to disable shadowing is important with some applications to resolve memory conflicts.

Hard disk interface Within the 386 PC environment, the three most common hard disk interfaces are *ST-506, SCSI (small computer system interface)*, and *ESDI (enhanced small device interface)*. ST-506 uses one of two data encoding methods, *RLL (run length limited)* and the older *MFM (modified frequency modulation)* scheme. All data is encoded onto and read from your hard disk as a series of polarity-reversing bits representing ones and zeros. The MFM format uses nine such bits to store the same amount of data that RLL can store with only six polarity changes.

Both SCSI and ESDI require special hard disk controllers and cannot run off existing PC-XT or PC AT controllers. A new interface that offers good performance at a lower price than ESDI or SCSI is *IDE (interface design enhancements)*.

Bus speeds Bus speed becomes more important as computers run at faster clock speeds. A computer's bus speed may actually be too fast for expansion cards, most of which operate at 8 MHz. Note that the Micro Channel bus operates at 14.5 MHz.

The **display circuitry** can be either on an expansion card or on the motherboard. Motherboard circuitry is often faster, but if it cannot be disabled it prevents upgrades.

Interface 16-bit video interfaces are typically faster than 8-bit because of their wider bandwidth.

Software available For DOS, OS/2, and *Microsoft Windows 386*, the version number and list price are provided. DOS 3.3 or 4.01 is normally included as part of *PC Magazine*'s standard configuration for computers.

Disk caching software Some companies provide software to facilitate data retrieval from the hard disk. This software speeds overall system performance by anticipating what data the processor will need next.

An **expanded memory manager** is software that emulates the Lotus Intel Microsoft (LIM) expanded memory manager within the extended memory of a 386 or 386SX PC.

Switchable settings on the power supply are designed to permit a computer's use in both the United States and Europe.

Number of device connectors indicates how many internal storage devices the system can support without the use of Y cables (power splitters).

Hard disk options The number of different hard disks the vendor offers for a machine is often indicative of how much customizing is available. We are listing what we believe are the most popular disk choices (100MB, 120MB, 150MB, 200MB, 300MB, 600MB, or the vendors' closest available models).

FCC certification class Two classes of FCC (Federal Communications Commission) approval, Class A and Class B, may be given to computers. Class A approval signifies that a computer has sufficiently low radio-frequency emissions for operation in a business locale. The more stringent Class B rating allows home use as well, where computers are likely to be placed near radios and television sets. All of the computers in the present roundup have been given Class B certification; therefore this question is not represented in the table.

	Altec Technology Corp. **ZIP-386**	American Research Corp. **ARC 386s/25c Skyscraper**	AT&T Computer Systems **AT&T 6386/25 WGS**	Blackship Computer Systems Inc. **Blackship BLK386/25V150**	Club American Technologies Inc. **Club Model 325Ci**	CompuAdd Corp. **CompuAdd 325**	Computer Market Place Inc. **Ultra 386-25C**
Price of standard configuration	$2,995	$4,300	$9,804	$4,120	$4,060	$3,742	$2,896
Hard disk capacity	105MB	150MB	135MB	120MB	150MB	110MB	100MB
TESTED CONFIGURATION							
Price of tested configuration	$3,325	$4,616	$9,804	$4,984	$4,040	$4,633	$3,457
Case type	Desktop	Tower	Desktop	Desktop	Desktop	Desktop	Desktop
Dimensions (HWD, in inches)	6.5 x 21.2 x 16.7	23.5 x 6.75 x 18	6.5 x 21.25 x 18.5	6.25 x 23 x 16.5	6.5 x 21 x 16.5	6.6 x 2.2 x 16.8	6.25 x 20.25 x 16.75
Motherboard manufacturer	Altec	ARC	Intel	Micronics	Club AT	CompuAdd	Laser Digital
386 chip set manufacturer	Chips and Technologies	Intel, ZyMOS	Intel	Chips and Technologies	Intel	Discrete logic, Chips and Technologies	Chips and Technologies
System RAM arrangement	Interleaved	Interleaved	Page-mode	Interleaved, page-mode	Interleaved, page-mode	Page-mode	Page-mode
Wait states	0	0	0	0	0	0	0, 1
MOTHERBOARD MEMORY							
Installed RAM	N/A	4MB	4MB	N/A	4MB	N/A	4MB
Maximum installable RAM	N/A	16MB	8MB	N/A	8MB	N/A	4MB
RAM packaging (and rated speed)	N/A	SIMM (80 ns.)	SIMM (100 ns.)	N/A	SIMM (100 ns.)	N/A	DIP (80 ns.)
Chip size	N/A	1Mb	1Mb	N/A	1Mb	N/A	1Mb
ADD-IN MEMORY BOARD							
Installed RAM	4MB	N/A	None	4MB	None	4MB	4MB
Maximum installable RAM	16MB	N/A	32MB	16MB	8MB	16MB	12MB
RAM packaging (and rated speed)	DIP, SIMM (80 ns.)	N/A	SIMM (100 ns.)	DIP (80 ns.)	SIMM (100 ns.)	SIMM (70 ns.)	DIP (80 ns.)
Chip size	1Mb	N/A	1Mb	256Kb, 1Mb	1Mb	1Mb	1Mb
PROCESSOR RAM CACHE							
Cache controller	Intel 82385	Austek	Discrete logic	Intel 82385	Discrete logic	Austek	Intel 82385
Installed RAM	32K	32K	64K	32K	64K	32K	32K
RAM packaging (and rated speed)	DIP (25 ns.)	DIP (25 ns.)	DIP (35 ns.)	DIP (35 ns.)	DIP (35 ns.)	DIP (25 ns.)	DIP (25 ns.)
Chip size	64Kb	8x8Kb	1x64Kb	32Kb	64Kb	64Kb	2x8Kb
Maximum installable RAM	32K	32K	64K	64K	256K	32K	32K
BIOS							
BIOS version and date	AMI (October 1989)	Phoenix 1.10 11 (January 1988)	Phoenix 1.5 (date not available)	Phoenix 1.10 10A (January 1988)	AMI (February 1989)	Award 3.04f (August 1989)	Award 3.05 (January 1990)
Setup in ROM	■	■	■	■	■	■	■
Password in ROM	❑	❑	■	❑	❑	❑	❑
Video shadowing/Can be disabled	■/■	❑/❑	■/■	■/■	■/■	■/■	■/■
System shadowing/Can be disabled	■/■	❑/❑	■/■	■/■	■/■	■/■	■/■
HARD DISK							
Manufacturer	NEC	Toshiba	Maxtor	Maxtor	Maxtor	Imprimis	Seagate
Disk capacity	150MB	150MB	135MB	150MB	150MB	150MB	120MB
Interface	ESDI	ESDI	ESDI	ESDI	ESDI	ESDI	RLL
Controller location	Card	Card	Card	Card	Card	Card	Card
Controller manufacturer	UltraStor	UltraStor	Western Digital	Western Digital	DTC	CompuAdd	Adaptec
Integrated floppy/hard disk controller	■	■	■	■	■	■	■
Drive bays	5 half-height	1 full-height, 2 half-height, 2 half-height 3.5-inch	5 half-height	5 half-height	5 half-height	5 half-height	2 full-height, 1 half-height (or 5 half-height)

□—Editor's Choice ■—Yes ❑—No
N/A—Not applicable: the product does not have this feature.

CONTINUES

25-MHz 386-BASED PCs: SUMMARY OF FEATURES

	Data General Corp. **Dasher/386-25k**	Digital Equipment Corp. **DECStation 325c**	Epson America Inc. **Epson Equity 386/25**	ESI Automated Office Systems Inc. **Challenger**	Gateway 2000 **Gateway 386/25 Cache Performer**	IBM Corp. **IBM PS/2 Model 80-A31**	NCR Workstation Products Division **NCR PC386**
Price of standard configuration	$5,690	$7,660	$7,527	$4,084	$3,495	$11,645	$9,094
Hard disk capacity	100MB	120MB	100MB	105MB	110MB	120MB	100MB
TESTED CONFIGURATION							
Price of tested configuration	$5,690	$9,115	$7,527	$4,084	$3,745	$16,140	$9,094
Case type	Small-footprint	Small-footprint	Desktop	Tower	Desktop	Tower	Desktop
Dimensions (HWD, in inches)	6.5 x 17.3 x 16.5	6.25 x 16.75 x 15.75	6.6 x 19.6 x 17.4	25.2 x 9.5 x 18.75	6.5 x 21.25 x 16.35	23.5 x 6.5 x 19.75	6.14 x 21.18 x 16.54
Motherboard manufacturer	Data General	Tandy	Epson	Amax	Micronics	IBM	AMI
386 chip set manufacturer	Chips and Technologies	Chips and Technologies	Intel	Chips and Technologies	Chips and Technologies	IBM	Intel
System RAM arrangement	Interleaved, page-mode	Page-mode	Row/column	Interleaved	Row/column	N/A	Row/column
Wait states	0	0	0	0	0	0–2	0
MOTHERBOARD MEMORY							
Installed RAM	4MB	N/A	N/A	4MB	N/A	N/A	4MB
Maximum installable RAM	8MB	N/A	N/A	8MB	N/A	N/A	8MB
RAM packaging (and rated speed)	SIMM (100 ns.)	N/A	N/A	SIMM (80 ns.)	N/A	N/A	DIP (70 ns.)
Chip size	1Mb	N/A	N/A	1Mb	N/A	N/A	1Mb
ADD-IN MEMORY BOARD							
Installed RAM	None	4MB	4MB	None	4MB	8MB	None
Maximum installable RAM	8MB	16MB	16MB	8MB	16MB	16MB	8MB
RAM packaging (and rated speed)	SIMM (100 ns.)	SIMM (100 ns.)	SIMM (80 ns.)	SIMM (80 ns.)	DIP (70 ns.)	DIP (80 ns.)	DIP (80 ns.)
Chip size	1Mb	1Mb	1Mb	1Mb	1Mb	1Mb	1Mb
PROCESSOR RAM CACHE							
Cache controller	Intel 82385	Intel 82385	Intel 82385	Discrete logic	Intel 82385	Intel 82385	AMI
Installed RAM	32K	32K	32K	64K	64K	64K	64K
RAM packaging (and rated speed)	DIP (25 ns.)	DIP (25 ns.)	DIP (25 ns.)	DIP (35 ns.)	DIP (25 ns.)	SIP (25 ns.)	DIP (25 ns.)
Chip size	32Kb	4x4Kb	4x4Kb	64Kb	64Kb	8x8Kb	64Kb
Maximum installable RAM	32K	32K	32K	64K	64K	64K	64K
BIOS							
BIOS version and date	Award 3.05 (February 1990)	Phoenix 1.10.00 D (enhanced) (November 1989)	Epson 1.3 (August 1989)	AMI (September 1989)	Phoenix 1.10.1a (1988)	IBM (1989)	AMI (April 1989)
Setup in ROM	■	❑	❑	■	■	❑	■
Password in ROM	❑	■	■	❑	❑	❑	❑
Video shadowing/Can be disabled	■/■	■/❑	■/■	■/■	■/■	❑/❑	■/■
System shadowing/Can be disabled	■/■	■/❑	■/■	■/■	■/■	❑/❑	■/❑
HARD DISK							
Manufacturer	Conner	Imprimis	Conner	Imprimis	Imprimis	IBM	Conner
Disk capacity	100MB	170MB	100MB	150MB	150MB	320MB	100MB
Interface	IDE	SCSI	IDE	ESDI	ESDI	SCSI	SCSI
Controller location	Motherboard	Card	Hard disk	Card	Card	Card	Card
Controller manufacturer	Data General	Adaptec	Conner	DTC	UltraStor	IBM	Western Digital
Integrated floppy/hard disk controller	■	❑	❑	■	■	❑	❑
Drive bays	2 half-height, 2 3.5- inch	2 half-height, 2 half-height 3.5-inch	5 half-height	6 half-height	2 full-height, 1 half-height; or 5 half-height	2 full-height or 4 half-height	2 full-height or 5 half-height

—Editor's Choice ■—Yes ❑—No
N/A—Not applicable: the product does not have this feature.

Pan United Corp. **Pan United PC 386/25 Cache**	PaoKu International Co Ltd. **Myoda MD7240**	Polywell Computers Inc. **Poly 386-25/Cache**	Star Industries Inc. **Americana 80386-25**	Tandy Corp. **Tandy 4025 LX**	Tatung Co. of America Inc. **Tatung TCS-8600T/25**	Telemart **MIT 386/25**	Toshiba America Information Systems Inc **Toshiba T8500 Model 25**	Tri-Star Computers Corp **Flash Cache 386/25**
$3,880	$3,499	$3,565	$4,239	$8,846	$5,895	$3,695	$6,998	$3,364
120MB	123MB	100MB	104MB	150MB	100MB	155MB	104MB	104MB
$3,880	$3,499	$4,800	$4,239	$8,846	$7,195	$3,695	$7,997	$3,575
Desktop	Tower	Mini-tower	Small-footprint	Small-footprint	Tower	Desktop	Small-footprint	Desktop
6.25 x 21 x 16.5	24.25 x 7.5 x 17.5	15.75 x 8.5 x 19.5	6.75 x 17.25 x 16	6.25 x 16.75 x 15.75	25.87 x 7.48 x 17.60	6.5 x 21 x 16.5	4.25 x 15.75 x 15.87	6.5 x 21 x 16.5
Datatech	AMI	Orchid	TMC	Tandy	Tatung	Micronics	Toshiba	Tri-Star
VLSI	Discrete logic	Chips and Technologies	Chips and Technologies	Chips and Technologies	Intel	Discrete logic	Toshiba	Discrete logic
Page-mode	Interleaved, page-mode	Interleaved, page-mode	Interleaved	Interleaved, page-mode	Page-mode	Interleaved, page-mode	Static-column	Interleaved, page-mode
0, 1, 2	0	0	0, 1	0	0	0	Variable	0
4MB	N/A	4MB	N/A	N/A	4MB	N/A	1MB	4MB
8MB	N/A	16MB	N/A	N/A	4MB	N/A	1MB	8MB
DIP (80 ns.)	N/A	SIMM (80 ns.)	N/A	N/A	SIMM (70 ns.)	N/A	ZIP (80 ns.)	SIMM (80 ns.)
1Mb	N/A	4x256Kb, 1Mb	N/A	N/A	1Mb	N/A	256Kb	1Mb
None	4MB	N/A	4MB	4MB	None	4MB	5MB	None
8MB	16MB	N/A	16MB	16MB	12MB	16MB	13MB	8MB
DIP (80 ns.)	DIP (80 ns.)	N/A	DIP (80 ns.)	SIMM (100 ns.)	SIMM (100 ns.)	DIP (80 ns.)	DIP, SIMM	SIMM (80 ns.)
1Mb	1Mb	N/A	1Mb	256Kb, 1Mb	1Mb	1Mb	256Kb	1Mb
Intel 82385	Discrete logic	Intel 82385	N/A	Intel 82385	Intel 82385	Intel 82385	Proprietary	Discrete logic
64K	64K	32K	N/A	32K	32K	64K	64K	64K
DIP (25 ns.)	DIP (25 ns.)	DIP (25 ns.)	N/A	DIP (25 ns.)	DIP (25 ns.)	SIMM (35 ns.)	DIP (25 ns.)	DIP (25 ns.)
64Kb	64Kb	32Kb	N/A	4x4Kb	4x4Kb	64Kb	32Kb	64Kb
256K	64K	32K	N/A	32K	32K	256K	64K	256K
Phoenix 1.10.01 (January 1989)	AMI (March 1989)	AMI for Orchid, 1.2a (April 1989)	AMI (March 1989)	Phoenix 1.10.00 (enhanced) (November 1989)	Phoenix 1.10.20 (February 1990)	Phoenix 1.10 10a (January 1988)	Toshiba 1.04.01 (May 1989)	AMI (April 1989)
■	■	■	■	❑	■	■	■	■
❑	❑	❑	❑	❑	❑	❑	❑	❑
■/■	■/■	■/■	■/■	❑/❑	■/■	■/■	■/■	■/■
■/■	■/■	■/■	■/■	❑/❑	■/■	■/■	■/■	■/■
Seagate	Seagate	CDC	Conner	Miniscribe	Imprimis	CDC	Conner	NEC
120MB	123MB	155MB	104MB	150MB	329MB	155MB	104MB	150MB
RLL	RLL	ESDI	IDE	ESDI	ESDI	ESDI	IDE	ESDI
Card	Card	Card	Card	Card	Card	Card	Motherboard	Card
Western Digital	Western Digital	UltraStor	Silicon Valley Computer	Western Digital	DPT	NDC	Toshiba	Western Digital
■	■	■	■	❑	❑	■	❑	■
2 full-height or 5 half-height	6 half-height	5 half-height	3 half-height, 1 full 3.5-inch	1 full-height or 2 half-height, 2 half-height 3.5-inch	6 half-height	5 half-height	1 full-height, 2 half-height	5 half-height

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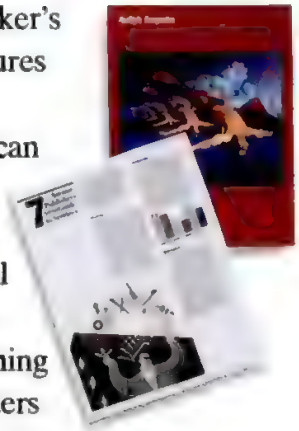

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25-MHz 386-BASED PCs: SUMMARY OF FEATURES

	Altec Technology Corp. **ZIP-386**	American Research Corp. **ARC 386s/25c Skyscraper**	AT&T Computer Systems **AT&T 6386/25 WGS**	Blackship Computer Systems Inc. **Blackship BLK386/25V150**	Club American Technologies Inc. **Club Model 325CI**	CompuAdd Corp. **CompuAdd 325**	Computer Market Place Inc. **Ultra 386-25C**
FLOPPY DISK DRIVES							
Type	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB, 1.44MB	1.2MB	1.2MB	1.2MB	1.2MB, 1.44MB
Manufacturer	TEAC	TEAC	Panasonic	TEAC	TEAC	Panasonic	Fujitsu
EXPANSION BUS							
Bus speeds (MHz)	8	8	8	8.3	8	8.33	8
Expansion slots	Two 8-bit, four 16-bit	Two 8-bit, six 16-bit	One 8-bit, five 16-bit, two 32-bit (proprietary)	Two 8-bit, five 16-bit, one 32-bit (proprietary)	One 8-bit, six 16-bit, one 32-bit (proprietary)	One 8-bit, six 16-bit	Two 8-bit, five 16-bit, one 32-bit (proprietary)
Slots left free after hard/floppy disk drives, video, one parallel and two serial ports are installed	3	3 – 5	6	5	5	5	4
Ports originate on motherboard	❑	❑	■	■	❑	■	❑
VIDEO							
Display circuitry location	Card	Card	Card	Card	Card	Card	Card
Interface	16-bit	16-bit	16-bit	16-bit	16-bit	16-bit	16-bit
Manufacturer	ATI	ARC	Western Digital	Orchid	Everex	Paradise	Ztech
Chip set manufacturer	ATI	Paradise	Paradise	Tseng Laboratories	Trident	Paradise	Western Digital
KEYBOARD							
Manufacturer	Focus Electronic	ARC	AT&T	Key Tronic	Key Tronic	Mitsumi	Nan Tan
Number of keys	110	101	101	101	101	101	101
Number of function keys	12	12	12	12	12	12	12
Keyboard cable length (inches)	84	84 (plus 72 extension)	96	90	72	100	84
SOFTWARE AVAILABLE							
DOS	3.3 (included)	4.01 (included)	4.01 (included)	4.01 (included)	3.3 ($60)	4.01 (included)	4.01 (included)
OS/2	None	1.1 ($300)	None	None	None	None	1.1 ($237)
Microsoft Windows 386	None	2.1 with mouse (included)	None	None	None	3.0 (included)	2.11 ($129)
Disk caching software	❑	❑	❑	❑	■	■	■
Expanded memory manager	■	❑	❑	■	❑	■	❑
Other	*Dr. Halo*, Video utilities	None	None	Video utilities	Video utilities	*PC-Fullback*, *386 LIMit*	*PC-Kwik*
MISCELLANEOUS							
Coprocessor supported	80387, Weitek 1167	80387, Weitek 1167 or 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 1167 or 3167	80387, Weitek 3167	80387, Weitek 3167
Physical features:							
Power supply (watts)	200	250	220	230	230	200	230
Switchable settings	■	■	■	■	■	■	■
Number of device connectors	4	5	5	4	4	5	4
Keyboard lock	Front	Front	Front	None	None	Front	Front
Case lock	Front	None	Front	Front	Front	Front	Front
Power-on switch	Side	Front	Side	Side	Side	Side	Side
Reset switch	Front	Front	Front	Front	Front	Front	Front
Hard disk options	150MB (IDE), 330MB (ESDI)	None	300MB (ESDI)	120MB (RLL); 338MB, 676MB (ESDI)	158MB, 338MB, 651MB (ESDI)	110MB (IDE); 320MB, 630MB (ESDI)	100MB (IDE); 150MB, 300MB, 600MB (SCSI, ESDI)
Warranty	1 year	1 year (2 years on system board)	1 year	1 year	1 year	1 year	1 year
Service	4 months on-site, then return to dealer	Return to dealer; on-site optional	Bring to depot; on-site optional	Return to dealer or manufacturer	Return to dealer or manufacturer	On-site	Express parts swap; on-site service

[ ]—Editor's Choice ■—Yes ❑—No
N/A—Not applicable: the product does not have this feature.

CONTINUES

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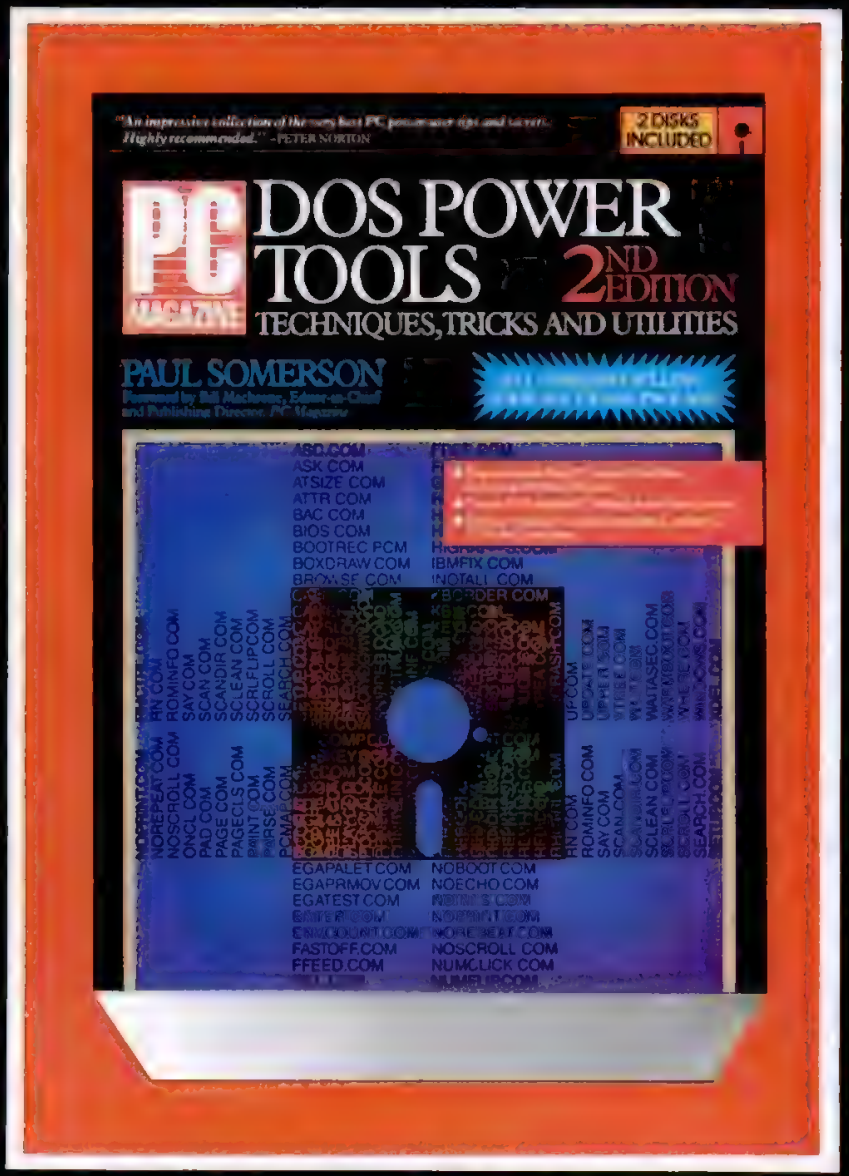

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mies of scale, some differences exist between them.

The DECstation 325c, which costs $7,660 in our standard configuration, can be scaled down to a basic configuration at $3,570 list; this includes 1MB RAM, one high-density 3.5-inch floppy disk drive, one parallel and one serial port, a mouse port, and assorted setup and utility software. The system provided for review added an extra 3MB of RAM, a 170MB hard disk and controller, a second high-density 3.5-inch floppy disk drive, a VGA card and color monitor, and DOS 3.3, for a total price of $9,115.

You should see little or no corner-cutting at this price, and the DECstation lives up to expectations. The front panel offers a reset button, keylock, and power switch. The reset is wisely placed far from everything but the keylock and is recessed to minimize the likelihood that you'll hit it accidentally. The power switch, however, is next to the floppy disk eject button, so you may wind up turning off the computer and losing data when you only wanted to remove a disk.

On the back of the system, you'll find the parallel port, the serial port, and connectors for the keyboard and mouse. The keyboard and mouse ports use PS/2-style connectors, while the serial port uses an AT-style DB-9. One of the few visible differences from the Tandy system is an extra power connector on the back to let you plug in a monitor.

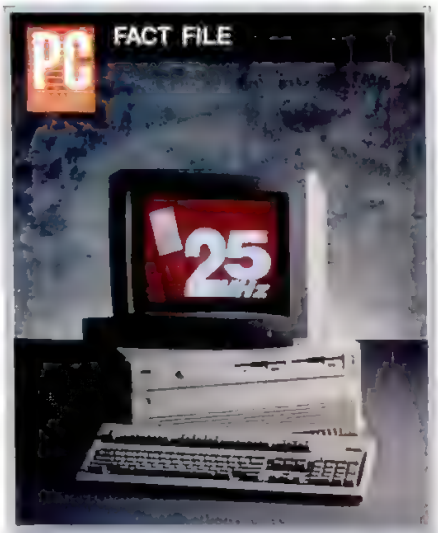
Only three screws hold the DECstation's case. Remove them and the case slides off easily, a sign of careful attention to fit and finish. Even with the case removed, the chassis resists flexing and offers solid support for the motherboard. Drive bays are surprisingly ample for a system that measures just 6.25 by 16.75 by 15.75 inches. On the tested system, both half-height 3.5-inch bays were occupied by the 1.44MB floppy disk drives. The full-height 5.25-inch bay was partly filled with an Imprimis 170MB SCSI hard disk, leaving room for another half-height device.

The system's Tandy-built motherboard uses a modified passive-backplane design, with two 32-bit slots for Tandy memory boards and one CPU slot for the Tandy CPU board. The CPU board has the 80386 on it, along with an Intel 82385 cache controller, 32K of 25-nanosecond static RAM cache, and a socket for an 80387 or Weitek 3167. In theory, the separate processor board means that you should be able to upgrade to a different processor by changing the board. But DEC currently has no other boards to swap to, and no immediate plans for any.

The memory boards include eight SIMM sockets each, for a maximum of 8MB RAM per board (16MB for the system). Since all RAM sits on the memory boards, one board is included with the system. The second board costs $180 without RAM. The review unit came with one board stocked with four 1MB SIMMs, using 100-ns. chips.

In addition to slots for the CPU board and memory boards, the motherboard contains the Chips and Technologies chip set, the parallel port and serial port, connectors for floppy disk drives and IDE hard disks, a DEC-modified version of the Tandy-modified Phoenix BIOS, and six 16-bit slots. Two of these slots align with the memory board slots, leaving room on the system for four full-length cards and two half-length cards.

Only two slots on the review unit were filled—one with a half-length Tandy 16-



DECstation 325c
Digital Equipment Corp., 146 Main St., Maynard, MA 01754; (800) 344-4825, (508) 493-5111.
List Price: With 1MB RAM, 1.44MB 3.5-inch floppy disk drive, one parallel and one serial port, mouse port, $3,570; with 4MB RAM, 120MB hard disk, monochrome VGA monitor, DOS 3.3, $7,660, with 170MB hard disk, two 1.44MB 3.5-inch floppy disk drives, color VGA monitor, $9,115.
In Short: The DECstation 325c offers quality construction, above-average performance, and more drive bays than you might expect in a small-footprint system. Although it's a close twin to the Tandy 4025 LX, it comes bundled with several extra utilities, including *QEMM* and DOS-level support for DEC printers.

CIRCLE 429 ON READER SERVICE CARD

25-MHz 386-BASED PCs: SUMMARY OF FEATURES

	Data General Corp. **Dasher/386-25k**	Digital Equipment Corp. **DECStation 325c**	Epson America Inc. **Epson Equity 386/25**	ESI Automated Office Systems Inc. **Challenger**	Gateway 2000 **Gateway 386/25 Cache Performer**	IBM Corp. **IBM PS/2 Model 80-A31**	NCR Workstation Products Division **NCR PC386**
FLOPPY DISK DRIVES							
Type	1.44MB	1.44MB (2)	1.2MB	1.2MB	1.2MB, 1.44MB	1.44MB	1.44MB
Manufacturer	TEAC	Sony	Canon	Chinon	TEAC	IBM	Sony/TEAC
EXPANSION BUS							
Bus speeds (MHz)	8	8	8	8	8, 11	Variable	8
Expansion slots	Four 16-bit, one 32-bit (proprietary)	Six 16-bit, two 32-bit (proprietary), one processor board slot (proprietary)	Three 8-bit, six 16-bit, one 32-bit (proprietary)	One 8-bit, five 16-bit, one 32-bit (proprietary)	Two 8-bit, five 16-bit, one 32-bit (proprietary)	Two 8-bit, two 8514 extended slots four 32-bit	One 8-bit, six 16-bit, one 32-bit (proprietary)
Slots left free after hard/floppy disk drives, video, one parallel and two serial ports are installed	5	3 – 5	7	4	4	6	6
Ports originate on motherboard	■	■	❑	❑	❑	■	❑
VIDEO							
Display circuitry location	Motherboard	Card	Card	Card	Card	Motherboard	Card
Interface	16-bit	16-bit	16-bit	16-bit	16-bit	8-bit	16-bit
Manufacturer	Data General	Tandy	Epson	Orchid	ATI	IBM	NCR
Chip set manufacturer	Chips and Technologies	Paradise	Paradise	Tseng Laboratories	ATI	IBM	Paradise
KEYBOARD							
Manufacturer	Fujitsu	Tandy	Epson	Monterey International	Fujitsu	IBM	NCR/TUV
Number of keys	101	101	101	101	101	101	101
Number of function keys	12	12	12	12	12	12	12
Keyboard cable length (inches)	68	105	96	78	96	108	96
SOFTWARE AVAILABLE							
DOS	4.01 (included)	3.3 (included), 4.01 ($150)	4.01 (included)	4.01 (included)	4.01 (included)	3.3 ($125), 4.01 ($150)	4.01 (included)
OS/2	None	1.1 ($340)	1.0 ($289)	None	None	1.2EE ($630)	1.1 ($325)
Microsoft Windows 386	None	None	None	3.0 ($115)	3.0 with mouse (included)	None	2.10 ($195)
Disk caching software	❑	❑	❑	None	❑	❑	❑
Expanded memory manager	■	■	■	None	■	❑	❑
Other	*QEMM*	*QEMM*	None	Video utilities	*QA Plus*	None	None
MISCELLANEOUS							
Coprocessor supported	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387	80387, Weitek 3167	80387	80387, Weitek 3167
Physical features:							
Power supply (watts)	185	200	232	230	200	242	230
Switchable settings	■	■	■	■	■	■	■
Number of device connectors	4	3	4	4	5	5	5
Keyboard lock	None	None	Front	Front	Front	Front	Front
Case lock	Front	Front	Front	None	Front	Side	Front
Power-on switch	Side	Front	Side	Front	Side	Front	Front
Reset switch	Front	Front	Front	Front	Front	None	None
Hard disk options	200MB (IDE); 330MB (ESDI)	120MB (IDE); 320MB (SCSI)	None	100MB, 130MB (MFM); 383MB (ESDI)	300MB, 600MB (ESDI)	120MB (SCSI)	115MB (ESDI); 327MB (SCSI)
Warranty	1 year	1 year	1 year	1 year	1 year	1 year limited	1 year
Service	Express parts swap; on-site optional	Return to manufacturer	Return to dealer; on-site optional	On-site	On-site	See your dealer	On-site

—Editor's Choice ■—Yes ❑—No

N/A—Not applicable: the product does not have this feature.

Pan United Corp. Pan United **PC 386/25 Cache**	PaoKu International Co. Ltd. **Myoda MD7240**	Polywell Computers Inc. **Poly 386-25/Cache**	Star Industries Inc. **Americana 80386-25**	Tandy Corp. **Tandy 4025 LX**	Tatung Co. of America Inc. **Tatung TCS-8600T/25**	Telemart **MIT 386/25**	Toshiba America Information Systems Inc. **Toshiba T8500 Model 25**	Tri-Star Computers Corp. **Flash Cache 386/25**
1.2MB TEAC	1.2MB, 1.44MB Toshiba	1.2MB, 1.44MB TEAC	1.2MB TEAC	1.44MB Sony	1.2MB, 1.44MB Panasonic/TEAC	1.2MB TEAC	1.44MB Toshiba	1.2MB, 1.44MB Mitsumi
8 Two 8-bit, six 16-bit, one 32-bit	8 Two 8-bit, five 16-bit, one 32-bit (proprietary)	8, 10, 12.5 Two 8-bit, five 16-bit	8, 10, 12 One 8-bit, five 16-bit, two 32-bit (proprietary)	8 Six 16-bit, two 32-bit (proprietary), one processor board slot (proprietary)	8, 12 Three 8-bit, five 16-bit	8.3, 12.5 Two 8-bit, five 16-bit, one 32-bit (proprietary)	10 One 8-bit, three 16-bit, one 16-bit (proprietary)	8 One 8-bit, six 16-bit, one 32-bit (proprietary)
5	5	4	3	1–3	5	4	4	5
❑	❑	❑	❑	■	❑	❑	■	❑
Card 16-bit Video Seven Video Seven	Card 16-bit Myoda Gemini	Card 16-bit TrueTech Zymos	Card 8-bit Hercules Intel	Card 16-bit Tandy Paradise	Card 16-bit Tatung ATI	Card 16-bit ATI ATI	Motherboard 16-bit Toshiba Paradise	Card 16-bit ATI ATI
Chicony	BTC	Focus Electronic	Honeywell	Fujiitsu	Forward Electronics	Monterey International	Toshiba Electronics	Key Tronic
101 12 96	101 12 80	111 12 72	101 12 102	101 12 100	101 12 96	101 12 72	101 12 50	101 12 72
4.01 (included) None None	4.01 (included) None None	4.01 (included) None None	4.01 (included) 1.1 ($269) 2.1 ($129)	3.31 ($120) 1.0 ($325) 2.11 ($195)	4.01 (included) None 3.0 (included)	3.3 (included) None 2.11 ($120)	4.01 (included) 1.1 ($325) None	3.3, 4.01 ($69) None None
❑ ■ None	❑ ❑ None	❑ ❑ Video utilities	❑ ❑ *Dr. Halo III*	■ ■ None	❑ ❑ None	❑ ■ None	■ ■ Hypertext on-line manual)	❑ ❑ None
80387, Weitek 3167	80387	80387, Weitek 3167	80287, 80387	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167	80387, Weitek 3167
220 ■ 4 Front Front Side Front 150MB (ESDI); 300MB (SCSI) 200MB (IDE);	200 ■ 4 None Front Front Front None 676MB (SCSI);	200 ■ 4 None Front Front Front 105MB, 128MB (RLL); 100MB, (SCSI) 150MB, 318MB (ESDI); 200MB, 350MB, 574MB (SCSI)	200 ■ 4 Front None Front Front 100MB, 200MB (IDE); 330MB, others by special order	200 ■ 3 None Front Front Front 150MB (ESDI); 170MB, 344MB	230 ■ 5 Front Front Front Front 150MB, 300MB, 600MB (ESDI)	200 ■ 4 None Front Side Front 150MB (ESDI) (IDE); 330MB,	170 ■ 3 Front None Front and back Front 100MB (IDE)	200 ■ 4 None Front Side Front 115MB (RLL); 104MB 200MB, 660MB (ESDI)
1 year	1 year	1 year (2 years motherboard, 5 years labor)	2 years	1 year	1 year	1 year	1 year	2 years
Return to manufacturer	Return to dealer or manufacturer	1 year on-site, then return to manufacturer	1 year on-site	Return to dealer; on-site optional	120 days on-site	On-site	On-site	1 year on-site, then return to dealer

ENDS

Make your keyboard A Northgate™ *OmniKey*...

Use One RISK FREE For 60 DAYS!

Hands down, Northgate *OmniKey* keyboards are the choice of experts and users alike! *PC Magazine* picked *OmniKey* from all the rest as their EDITORS' CHOICE. Readers of *Computer Shopper* made it their "Best Buy" selection. In fact, every article ever written about an *OmniKey* has been a rave review!

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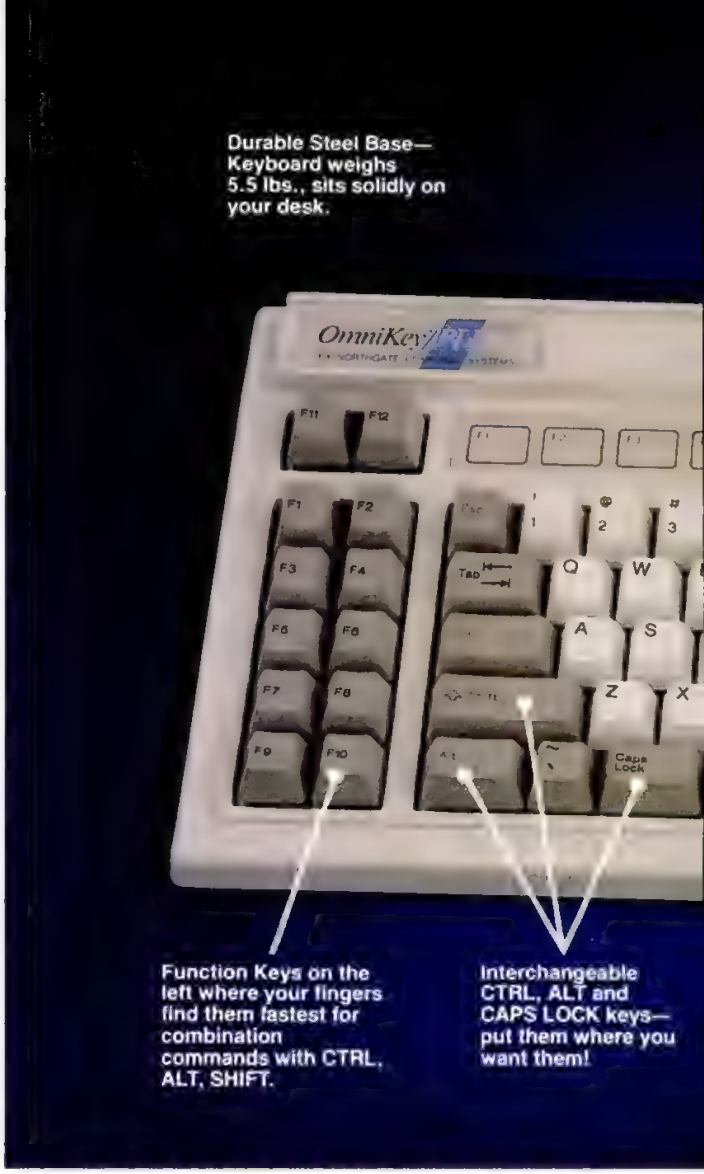

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Let your fingers dance with *OmniKey*/PLUS—you'll wonder how you got along without it for so long! Its keys are crisp to the touch. The sound is precise. The increased accuracy of your typing or data input will astound you!

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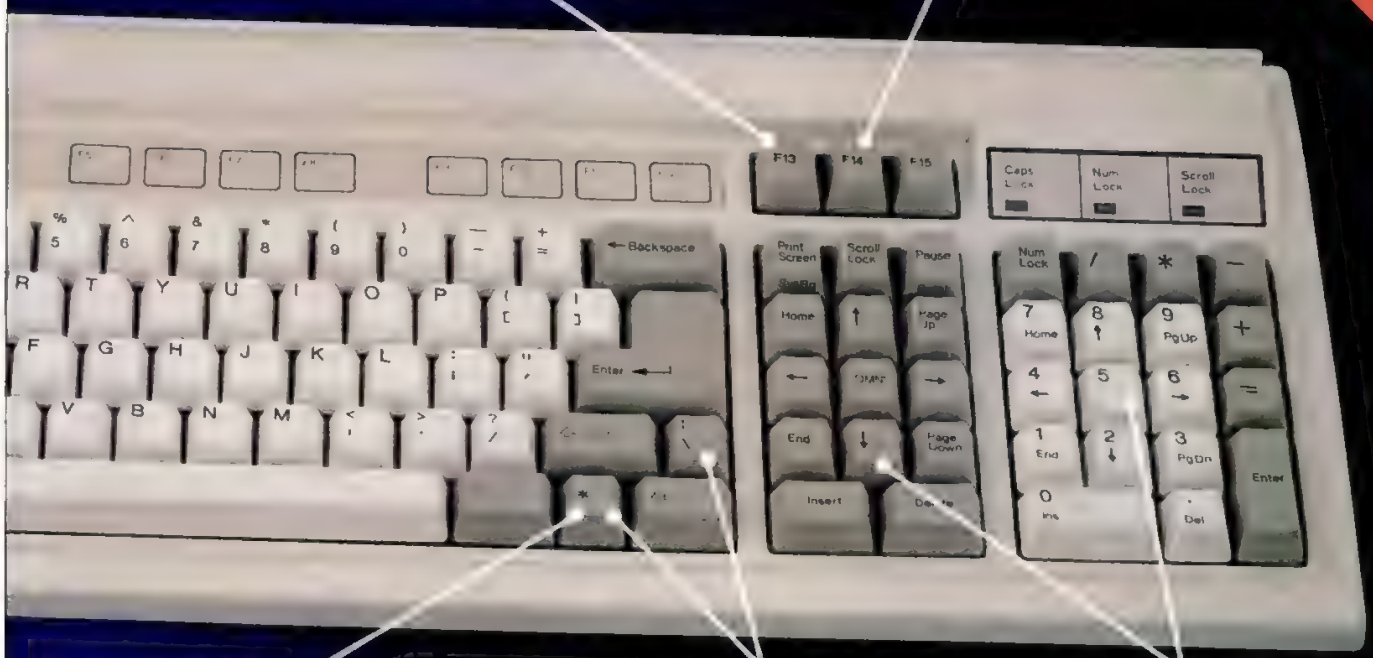
PC MAGAZINE EDITORS' CHOICE

"Editors' Choice" says *PC Magazine!*

OmniKey/PLUS "... Northgate has mastered the layout that IBM lacked ..."

"Many of us who learned to type on original PC or XT keyboards were thrilled to have the function keys back home where they belong."

Turn the page! See the rest of Northgate's impressive OmniKey line!



Computer Shopper readers vote it "Best Buy!"

"By combining the best features of both old and new PC keyboard layouts, Northgate has created a unique input device and one that carries an industry-wide reputation for quality, design and performance."

Check out these exclusive *OmniKey* features:

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Two independent keypads...

Cursor control pad: All screen controls are on this pad with cursor arrows in a convenient diamond pattern for those who prefer this layout over the IBM™ Inverted T.

NEW! If you do prefer the Inverted T, the key in the center of the cursor arrows is a down arrow cursor key. INSERT and DELETE keys at bottom of pad are large and easy to hit.

Numeric Keypad: No need to use NUMLOCK when you want to enter numbers. Large INSERT and ENTER keys make number manipulation a breeze.

Instantly change repeat character rate! Press F14 key and you select a repeat rate from 3-120 CPS. Perfect for racing through a spreadsheet. No run-on either!

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You can even swap the ALT and CONTROL keys on the right; Switch the backslash and asterisk keys—it's up to you! **Talk about flexibility!**

Put *OmniKey*/PLUS to work for you—call for your no-risk 60-day trial today!

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OmniKey™/101

More features! ESCAPE Key is positioned next to #1. Plus, we added an asterisk key on bottom row to speed wildcard commands. Includes Comma/Period lockout feature AND adjustable cursor rate capability.

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Northgate put the function keys back on the left!

The first keyboard to get back to the basics with 12 function keys on the left. A modification most people prefer!

Two separate keypads! One IBM style inverted T for cursor control; second for numeric entry functions.

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bit VGA card, the other with an Adaptec SCSI controller. DEC provided the SCSI controller and hard disk rather than using the IDE connector on the motherboard because the highest-capacity IDE disk the company offers is 40MB. In fact, the hard disk choices are so limited—20MB, 40MB, 80MB, and 170MB—that you may want to shop for your hard disk elsewhere.

On PC Labs' benchmark tests, the DECstation's performance was in the top tier for video tests and for processor and memory tests. Disk performance was uneven, with results that ranged from among the best to among the worst of the systems tested. Consider this another reason to shop for your hard disk elsewhere.

Most of these comments about the DECstation apply just as well to the Tandy 4025 LX. DEC says there are a number of "subtle differences" in the BIOS and setup for the two machines. The company also stresses that the DECstation and the 4025 LX are built on two different production lines, with DEC handling the quality control for the DECstation version. It's not clear how important this difference is; both systems have a mean time between failure of about 30,000 hours.

One difference between the systems is the way they are sold. The Tandy system is available through Tandy's retail (Radio Shack) stores, and through its direct sales force. The DECstation is sold by DEC's direct sales force and by relatively few distributors. DEC says that it has no current plans to sell the unit retail, although nothing is preventing this. In the meantime, individuals can buy the unit through DEC's distributors.

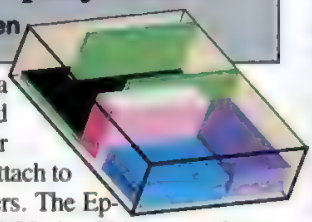
Other differences are limited to options, utilities, and service. DEC's choice of disk drives, for example, is narrower than Tandy's. But the DECstation comes with more utility programs. DEC's DOS disk includes such useful tools as an encryption utility, a compression/decompression utility, and a utility for defragmenting files on a hard disk. It also includes such DEC-specific tools as DOS-level support for most DEC printers. And the system comes with *QEMM* as part of the package. The one-year warranty is handled by DEC itself, with optional on-site service available through DEC service centers.

All told, the DECstation 325c offers high-quality construction, better-than-average performance, and room for expansion in a small-footprint case. If that's what you're looking for, the system's chief competitor is its Tandy twin, and the difference is minimal. But if your office is a DEC shop, the DECstation certainly has the edge.

EPSON AMERICA INC.

Epson Equity 386/25

by Bill O'Brien



Epson America seems destined to create faster computers to attach to its faster printers. The Epson Equity 386/25 should be more than a handful for any of the Epson printers. This 25-MHz 386 offspring of the Equity line sits in a desktop case (6.6 by 19.6 by 17.4 inches) that looks more like a sculpture than the plain gray computer box from the days of old.

Slide off the lid of this $7,527 machine and you'll find the functionality that gave rise to the form. Ten I/O slots grace an Epson motherboard that is powered by an Intel chip set. A memory expansion board occupies one slot, but even with hard and floppy disk drives installed, along with a parallel and a serial port, seven I/O slots remain available for expansion. The Equity comes with a 232-watt power supply to satisfy the robust power requirements of the many card combinations the machine gives you room to use.

The Equity 386/25 arrived at PC Labs with 4MB of 80-nanosecond system memory installed—2MB more than is normally found in the base version of this machine. According to Epson, the system memory uses a row/column arrangement, an old and inefficient access scheme that tended to slow down the machine's benchmark test results.

Even the hyperfast 32K of 25-ns. processor RAM cache couldn't drag anything better than mediocre processor and memory performance out of the Equity 386/25. Boosting the system RAM count should not have a noticeable effect on test results (as it might with interleaved or fast paged RAM), and with RAM costs at a list price of almost $500 per megabyte, the performance gains would have to be dramatic to justify the cost of the upgrade.

Disk speed proved equally disappointing. Without the benefit of hardware or software caching, the Conner drive that shipped with the unit achieved middling performance on the three disk tests and produced the kind of results more commonly seen in the hard disks shipped with 16-MHz and 20-MHz computers. Given the fact that the 100MB drive is a $2,000 option, its performance was decidedly unspectacular.

Epson has made some strides in the areas of human-to-computer interfacing. Its keyboard, always known for its highly sculptured contour, is a responsive unit that offers neutral resistance and a limited and likable amount of tactile and audio feedback. The VGA video display system is well made, as you might expect from a Paradise chip set–governed, 16-bit Epson board. Unfortunately, visual satisfaction may be all that you derive from it. According to PC Labs' video benchmark test results, the card responds quickly to direct video writes to the hardware but lags somewhat in BIOS-oriented operations, as measured by the Video BIOS Routine tests with and without scrolling.

While Epson has put together an aesthetically pleasing package, the Epson Equity 386/25 seems to have settled into a

FACT FILE

Epson Equity 386/25
Epson America Inc., 2780 Lomita Blvd., Torrance, CA 90505; (800) 922-8911, (213) 539-9140.
List Price: With 2MB RAM, 1.2MB 5.25-inch floppy disk drive, VGA card, one parallel and one serial port, one mouse port, DOS 4.01, $4,199; with 4MB RAM, 100MB hard disk, VGA monitor, $7,527.
In Short: The Epson Equity 386/25 would look good on any desk, but its price/performance ratio may be quite prohibitive for all but the most devoted brand-name enthusiast.

CIRCLE 542 ON READER SERVICE CARD

price and performance niche of its own making. With the base machine priced at $4,199 (with 2MB of RAM) and a $1,599 premium required to add a VGA monitor and a tiny 40MB hard disk, it's difficult to give this one a passing grade.

ESI AUTOMATED OFFICE SYSTEMS INC.

Challenger

by Alfred Poor

In any competitive arena, whether it is sports or business, there are always players who seek to gain an edge on the rest of the field by bending the rules a little. The Challenger, from ESI Automated Office Systems, is much like many other compatible machines that compete at the low end of the price scale, but it has some unique features that push the limits of its class.

This extra edge doesn't cost much more. In our standard configuration, with 4MB of RAM, a 150MB hard disk, and VGA monitor, the Challenger lists for an aggressive $4,084. So what is the edge, and is it worthwhile?

The Challenger gets its better performance by running the CPU faster than it was designed to be run. The reviewed computer came with a standard Intel 80386 chip rated for 25-MHz operation, but the 54-MHz crystal on the motherboard pushes it beyond its spec to 27 MHz. This will give you a theoretical 8 percent boost in performance for CPU operations, though other operations will not be increased by that full amount since other system components are involved.

There is probably little risk that this small speed increase will cause any harm to the Challenger's 386 chip or to the rest of the system. ESI Automated Office Systems stands behind the product with a full-year parts-and-labor warranty, with service provided on-site by TRW. Still, this design is outside Intel's approved specifications, and Intel would not honor its separate warranty on the 386 in the event of its failure.

Aside from the pushed CPU design, the Challenger is fairly similar to the rest of its class. The American-made motherboard has a 64K static RAM cache, room for 8MB in 1MB SIMMs, and seven slots, one of which is an Intel-compatible 32-bit slot that can also be used as an 8-bit or 16-bit slot instead. The Imprimis hard disk and Chinon floppy disk drive are driven by a DTC floppy/hard disk controller. The parallel, serial, and game ports are on a no-name multi-I/O card. Our test unit also came with Orchid Technology's ProDesigner VGA adapter and a Panasonic PanaSynch 800- by 600-pixel color monitor. The system comes packaged in either a mini-tower case or the full-size tower case that was provided with our test unit; both cost the same.

Challenger
ESI Automated Office Systems Inc., 6760 Miller Rd., Brecksville, OH 44141; (800) 837-5999, (216) 838-4060.
List Price: With 1MB RAM, 40MB hard disk, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, VGA monitor, DOS 3.3 or 4.01, $3,269; with 4MB RAM, 150MB hard disk, $4,084.
In Short: The Challenger pushes its CPU over its specified rating to 27 MHz. This produces a small performance gain, but the system's value suffers through design flaws and details that fall short of the mark.

CIRCLE 543 ON READER SERVICE CARD

The Challenger showed some signs of cut corners and questionable design. Two of the expansion slots cannot be used with full-length cards when all the SIMMs are in place, and two more might conflict with the SIMMs if the cards are thicker than the minimum. The power and reset switches stick out from the front panel and are easy to hit, causing an inadvertent reset. The turbo switch on the front panel is nonfunctional, as is the turbo speed indicator light. You can change speeds from the keyboard with a combination keystroke, but there is no indication that you have changed processor speeds. A beep would be welcome, to let you know that something has happened; otherwise, your system might slow to a crawl and you might have no idea what you had done.

According to the company's technical representative, the system should have issued a beep on speed change and the turbo light should have functioned using the keyboard command. On the other hand, the same representative was unaware that the system was running at 27 MHz, which calls into question the person's familiarity with the system's design. In fact, the system is designed and built for ESI Automated Office Systems by Amax Engineering Corp.—the tower case provided with our test unit even bore an Amax label—and an ESI representative referred me to Amax engineers for technical information.

There were also indications that fit and finish were below par, not to mention that the computer's .22 pounds of documentation is probably the smallest amount provided by any vendor in this group.

In the end, you probably get less than you might expect with the Challenger. There is a small benefit from jacking up the clock speed, but this is more than offset by the design flaws, lack of documentation, and poor fit and finish. The unit performed well on our processor and memory benchmark tests but only poor to middling on most of the others. On the Video BIOS Routine tests, its times were especially slow.

The Challenger may have found some competitive advantage by bending the rules, but there are other products that offer a better value even though they stick to the straight and narrow.

GATEWAY 2000

Gateway 386/25 Cache Performer

by Bill O'Brien

Magic is something that can't be explained. With the prices of computers in this review sometimes rising above $10,000, it's magic that Gateway 2000 can offer its 25-MHz desktop unit, in our standard configuration, for $3,495.

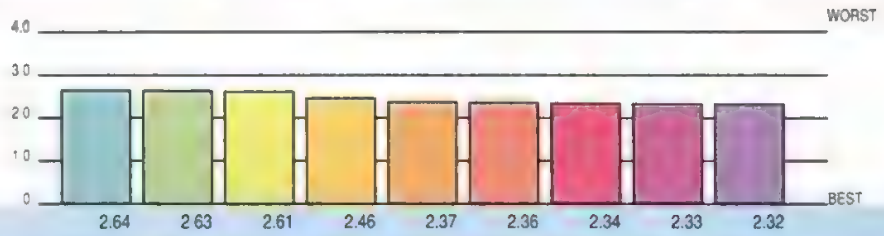
BENCHMARK TESTS: 25-MHz 386-BASED PCs

Among these 25-MHz 386s, the Club Model 325Ci and the Flash Cache 386/25 achieved top scores on our 80386 Instruction Mix and Floating-Point Calculation tests thanks to 64K of processor RAM cache, while the hard disk caching controllers of the CompuAdd 325 (with 1MB RAM) and the Tatung TCS-8600T/25 (with 512K RAM) turned in great performance on our disk benchmark tests.

PROCESSOR AND MEMORY BENCHMARK TESTS

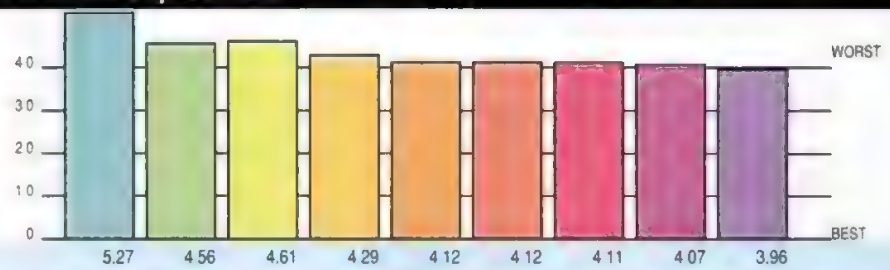
80386 Instruction Mix

The **80386 Instruction Mix** benchmark test times a series of tasks specific to the 80386 chip. Since this test shows how the CPU operates in the context of the bus, processor, system memory, and motherboard architecture, a faster time means better overall computer performance.



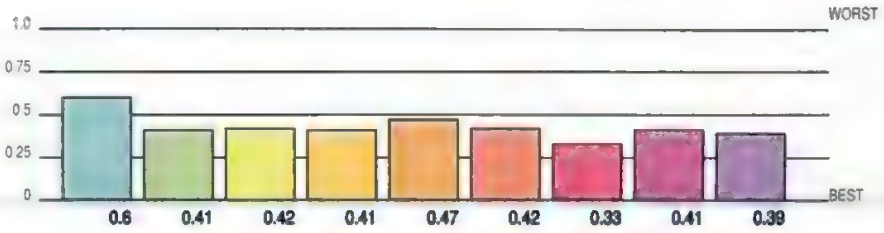
Floating-Point Calculation Without Coprocessor

The **Floating-Point Calculation Without Coprocessor** benchmark test sets up a floating-point emulation program in RAM and then exercises the processor and tests RAM access speeds during floating-point calculations.



Conventional Memory

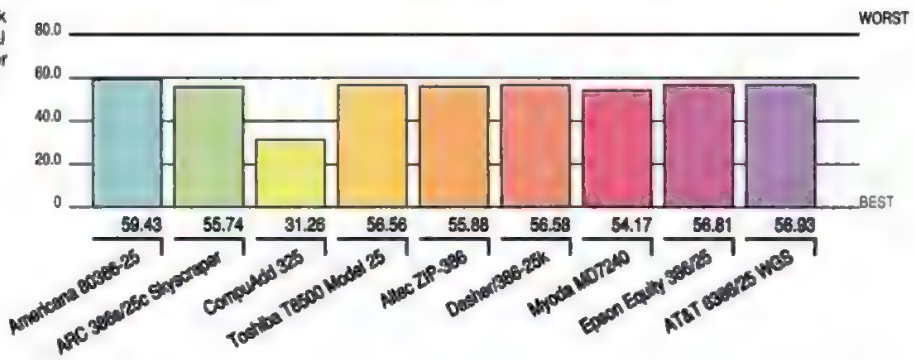
The **Conventional Memory** benchmark test measures the read/write speed of the first 640K of memory. Slower relative times can indicate the presence of memory wait states or memory chips rated at slower access speeds.



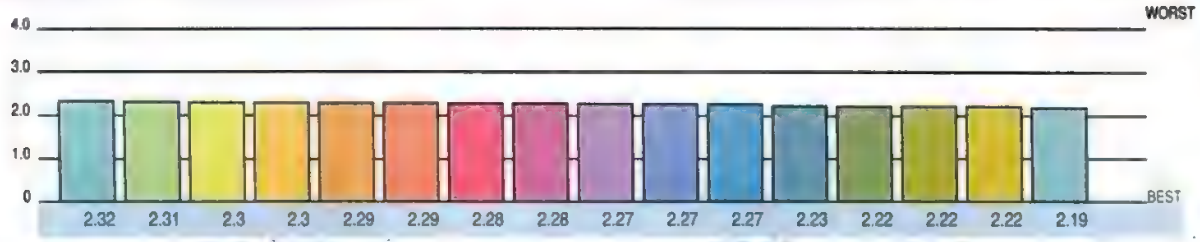
DISK BENCHMARK TESTS

DOS File Access (Small Records)

The **DOS File Access (Small Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. The test is performed without software disk caching. Fast times are advantageous for programs that work with many short segments of data.



Elapsed Time (seconds)



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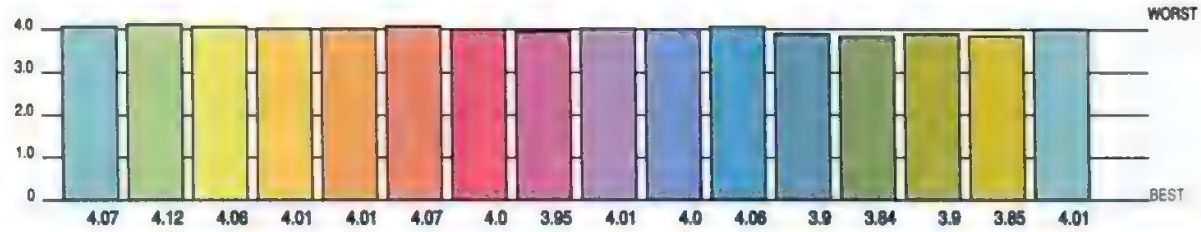

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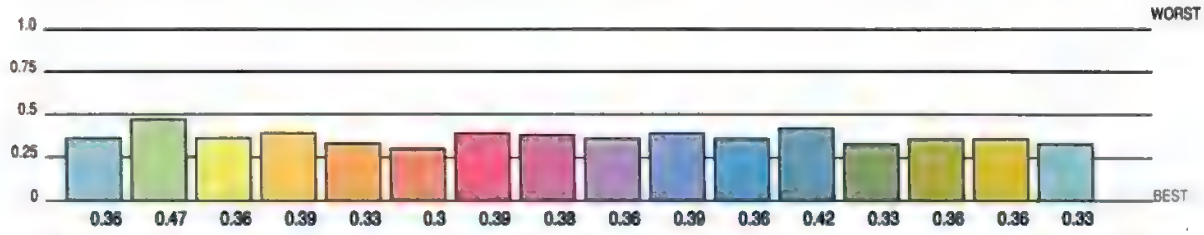
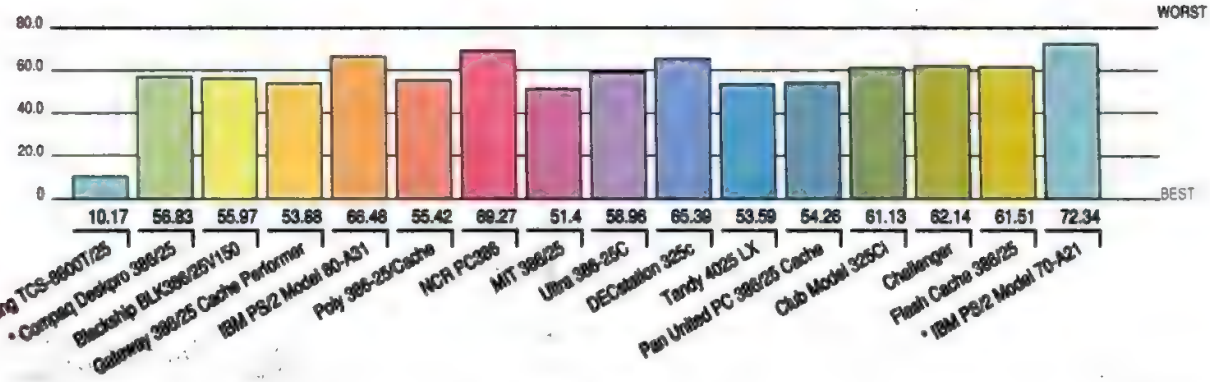


Elapsed Time (seconds)



* Reported for comparison.

CONTINUES

My network in marketing won't share

Now what?

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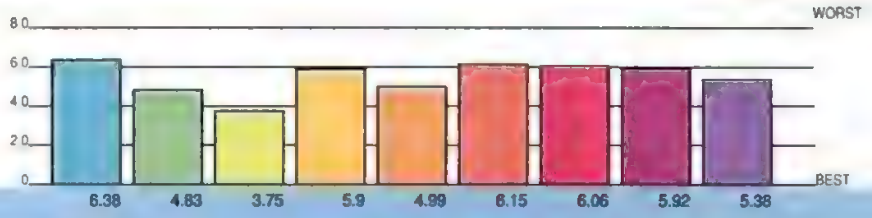
CIRCLE 293 ON READER SERVICE CARD

BENCHMARK TESTS: 25-MHz 386-BASED PCs

DISK BENCHMARK TESTS

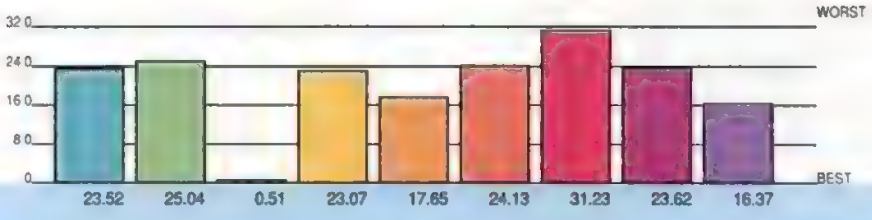
DOS File Access (Large Records)

The **DOS File Access (Large Records)** benchmark test times disk throughput as a result of mechanical disk drive speed, hard disk controller function, and bus speed. This test minimizes the effect of small hardware caches on disk subsystem performance. It is performed without software disk caching. Fast times are advantageous when large files are loaded.



BIOS Disk Seek

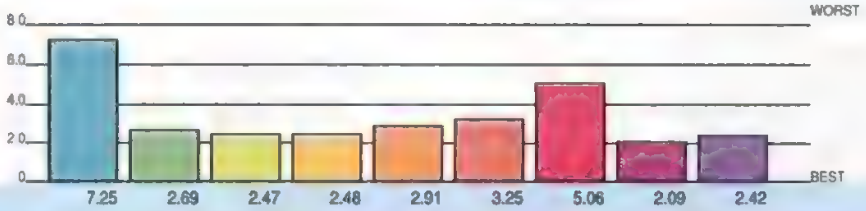
The **BIOS Disk Seek** benchmark test measures mechanical track-to-track disk drive access times. Fast times are helpful with programs such as databases, which often store and must later find data in many separate places on a drive.



VIDEO BENCHMARK TESTS

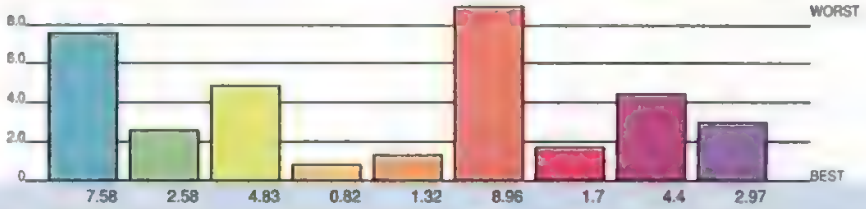
Direct to Screen

The **Direct to Screen** benchmark test indicates the speed of the video adapter memory. Good scores indicate that information can get to the screen quickly, particularly for programs that avoid the computer's BIOS and go directly to the screen.



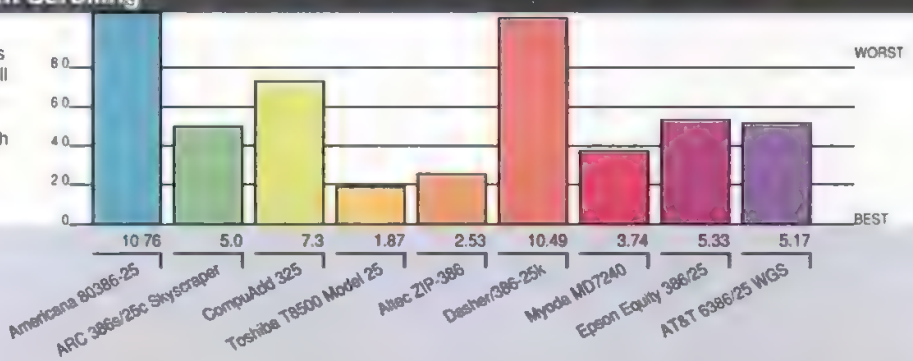
Video BIOS Routine Without Scrolling

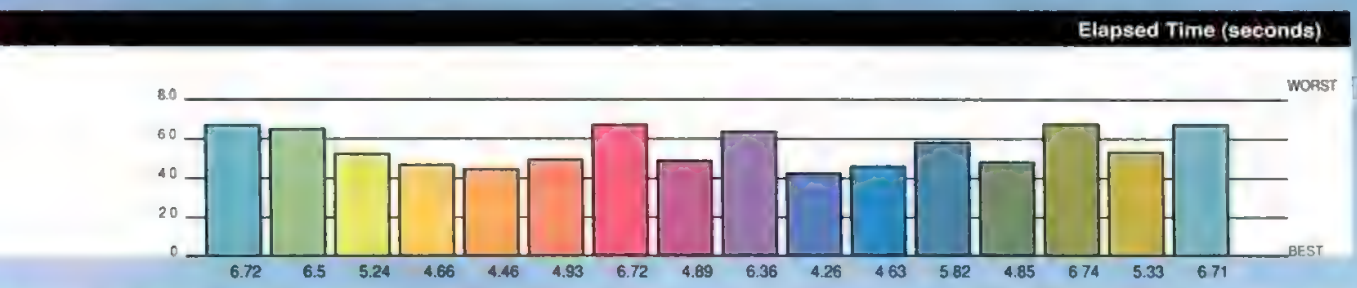
The **Video BIOS Routine Without Scrolling** benchmark test measures how quickly the BIOS on the video adapter writes text data to the screen. Fast video writing helps with programs that show full or partial screens of data without scrolling the screen.

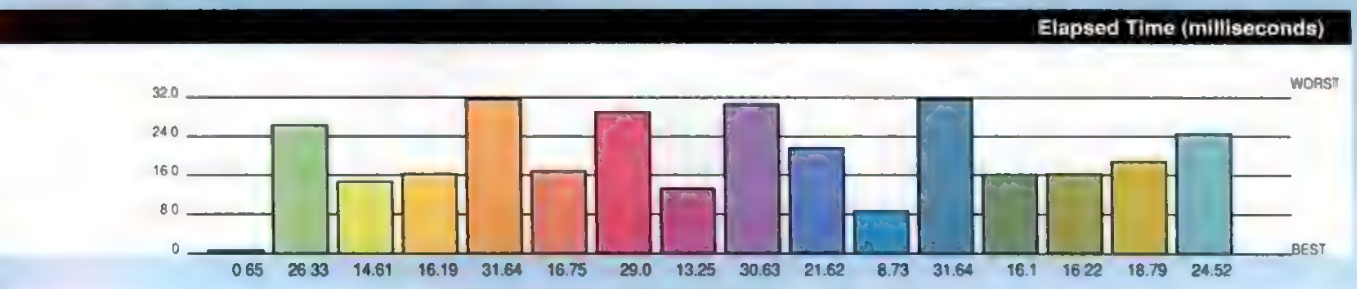


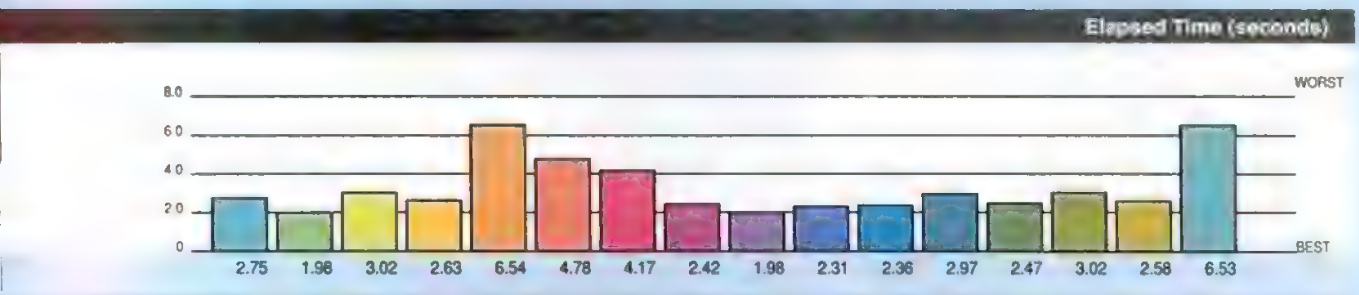
Video BIOS Routine with Scrolling

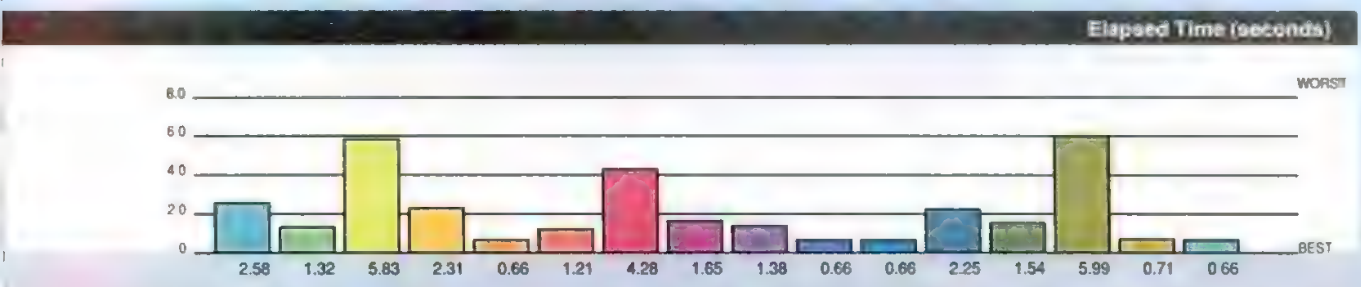
The **Video BIOS Routine with Scrolling** benchmark test measures how fast the video adapter can scroll the screen, moving the display up one line at a time. Good performance is helpful for scrolling through word processing or spreadsheet files.

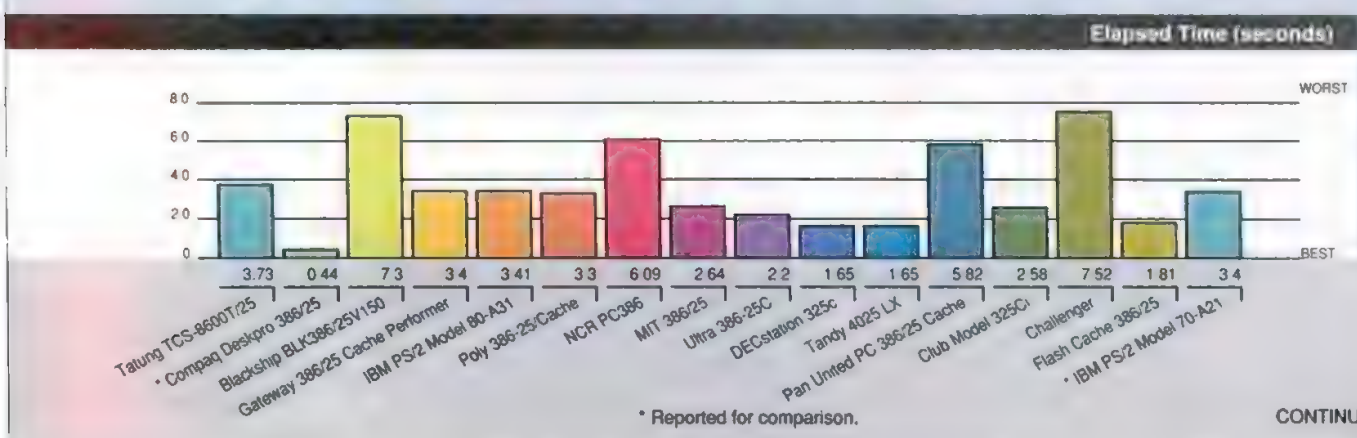












* Reported for comparison.

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Processor/Speed (MHz)	i486/33	i486/25	i486/25	386/33	386/33
Expansion Bus	EISA	EISA	ISA	EISA	ISA
Expansion Slots	10	10	10	10	10
Drive Bays	6	6	6	6	6

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AST COMPUTERS

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CIRCLE 166 ON READER SERVICE CARD

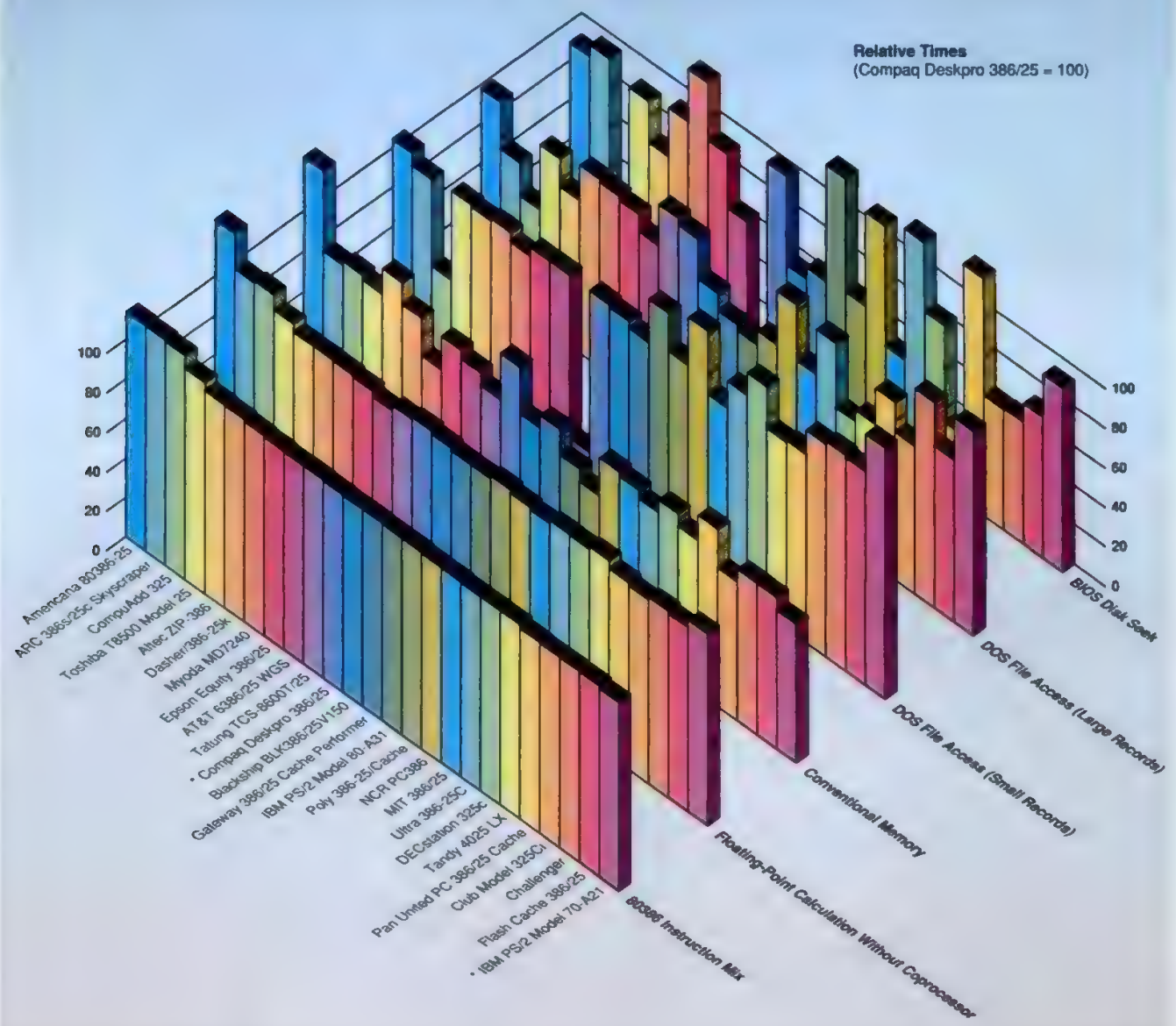
PROCESSOR, MEMORY, AND DISK BENCHMARK TESTS: COMPOSITE VIEW

PC Labs tested 23 computers in the 25-MHz 80386 class and normalized them against the popular Compaq Deskpro 386/25. Test results for the IBM PS/2 Model 70-A21 are also reported for comparison.

In the 80386 Instruction Mix and Floating-Point Calculation tests, the ranking of the tested machines is fairly consistent, with the Club Model 325Ci and the Flash Cache 386/25 pulling in the best scores, while the Challenger and the Pan United PC 386/25 Cache came in a close second. All four machines have a 64K processor RAM cache, which gives them the upper hand.

The Americana 80386-25's inferior performance on those two tests results from the lack of a cache, which was also responsible for the machine's poor score on the Conventional Memory test. The Poly 386-25/Cache achieved a score of .30 seconds on the Conventional Memory test, outrunning all of the machines in our previous roundup of 25-MHz PCs (*PC Magazine*, November 28, 1989). Note that the Dasher/386-25k was tested with system shadowing on, because turning it off disables the cache.

Hard disk caching controllers gave the Tatung TCS-8600T/25 and the CompuAdd 325 by far the fastest numbers on the small-record DOS File Access and the BIOS Disk Seek tests. The Tatung's configuration included a Toshiba controller with 512K cache, while the CompuAdd had a CompuAdd controller with 1MB cache installed, which enabled it to perform especially well on the large-record DOS File Access test. The performance of the Tandy 4025 LX on the BIOS Disk Seek test is worth noting; while it had no caching controller, it was nearly 6 seconds faster than the other leaders of the pack, excluding the Tatung and CompuAdd.



* Reported for comparison.

CONTINUES

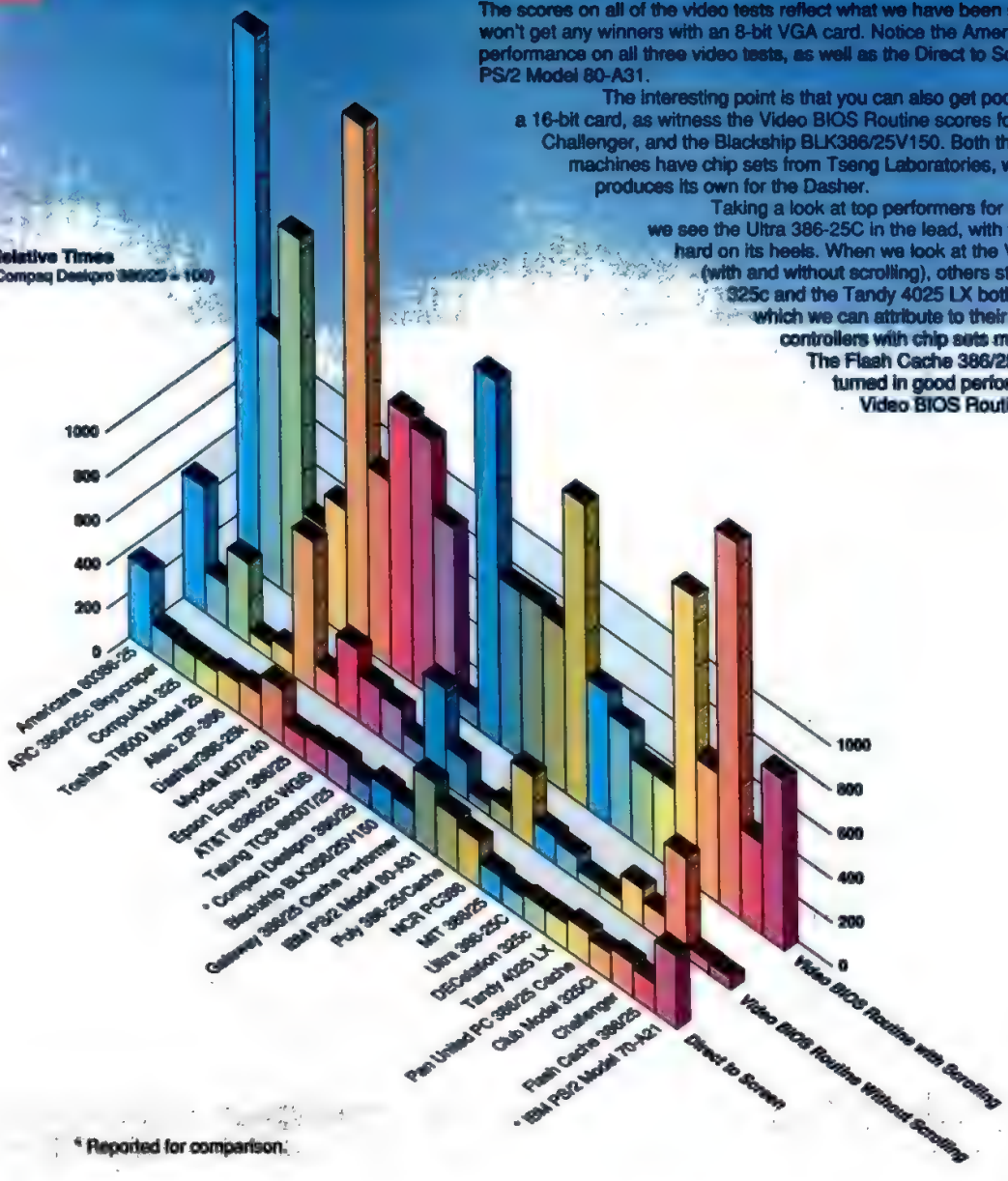
VIDEO BENCHMARK TESTS: COMPOSITE VIEW

PC LABS

The scores on all of the video tests reflect what we have been saying for a while: you won't get any winners with an 8-bit VGA card. Notice the Americana 80286-25's slow performance on all three video tests, as well as the Direct to Screen time for the IBM PS/2 Model 80-A31.

The interesting point is that you can also get poor video performance with a 16-bit card, as witness the Video BIOS Routine scores for the Dasher/386-25k, the Challenger, and the Blackship BLK386/25V150. Both the ESI and Blackship machines have chip sets from Tseng Laboratories, while Data General Corp. produces its own for the Dasher.

Taking a look at top performers for the Direct to Screen test, we see the Ultra 386-25C in the lead, with the Epson Equity 386/25 hard on its heels. When we look at the Video BIOS Routine tests (with and without scrolling), others stand out. The DECstation 325c and the Tandy 4025 LX both turned in top results, which we can attribute to their use of Tandy 16-bit controllers with chip sets manufactured by Paradise. The Flash Cache 386/25, with an ATI 16-bit card, turned in good performance times on both Video BIOS Routine tests as well.



* Reported for comparison.

END8

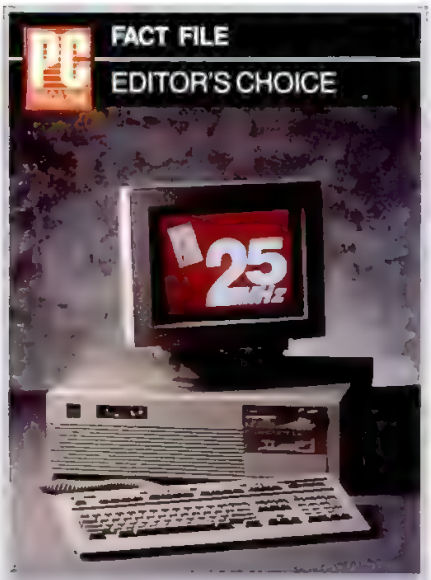
The hard facts are that the Gateway 386/25 is founded on a Micronics motherboard with a Chips and Technologies 80386 chip set and Phoenix BIOS; processor RAM cache is at its full complement of 64K of 25-nanosecond static cache devices, and an Intel controller regulates its operation. Add the 4MB of 70-ns. system RAM (operating from an installed card in a proprietary slot), and the Gateway 386/25 manages to dive into the middle of the group, according to PC Labs' processor and memory benchmark tests. So there is a small compromise in performance, but it's minuscule in the light of the price/performance quotient of its nearest competitor, the NCR PC386.

Gateway has stuffed an Imprimis 150MB hard disk into the box and tied it to an UltraStor ESDI controller card. The card contains 32K of cache (it's available with as little as 8K), and the combined drive and controller earned the unit a better-than-average score on our BIOS Disk Seek test. It even handled the large-record DOS File Access test creditably, although the controller card has a comparatively small buffer size.

There are no obvious complaints to be registered concerning the 101-key keyboard. Manufactured by Fujitsu, the keyboard has excellent tactile response and a nonaggressive amount of key resistance that should suit most fingers quite well. The video display system was equally problem-free. The Gateway 386/25 uses a 16-bit ATI VGA Wonder card with an ATI BIOS, with middling video test results.

Gateway has taken a small shortcut at

the power supply. Many of the units reviewed contained 220-watt or better supplies to feed their slots in their 80386s. The Gateway computer has only a 200-watt Astec supply for its eight slots. The Astec power supply comes from a prominent manufacturer (compared with the abundance of odd-named offshore devices that could have been used), but with other vendors opting for larger capacity, one has to wonder at the choice. Gateway feels that this is an honest 200-watt supply and should handle all but outrageous demands on the four available motherboard slots or vacant half-height drive bays.



Gateway 386/25 Cache Performer
Gateway 2000, 610 Gateway Dr., P.O. Box 2000, N. Sioux City, SD 57049, (800) 523-2000.
List Price: With 4MB RAM, 65MB hard disk, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, VGA monitor, one parallel and two serial ports, DOS 4.01, *QA Plus*, $3,145; 110MB hard disk, $3,495; with 150MB hard disk, $3,745.
In Short: Despite some shortcomings in performance and components, this unit combines a good price/performance ratio with an excellent service policy, making it a more appealing choice than many of its competitors.

CIRCLE 544 ON READER SERVICE CARD

Even if the overall Gateway 386/25 performance scores don't really impress you, you can heighten the magic by settling for a 65MB hard disk and cutting $350 off the price of our standard configuration. (There's even a 40MB hard disk option, but at 386 levels of software magnitude, a drive that small could fill up in six months.) Of course, at $3,495 with 4MB RAM, a 110MB Microscience ESDI hard disk, and dual floppy disk drives, the standard-configuration system is not undesirable either. Add to the attractive pricing a call-in parts-swap warranty service and the machine becomes almost irresistible. And, under the one-year warranty, if the Gateway tech support reps can't resolve your problems through phone service, they will call TRW and authorize on-site service for the machine. That's magic.

The Gateway 386/25 Cache Performer gives you decent performance at an affordable price for its class. It is one of the few hands-down best-byte-for-the-buck choices available, and it would be no embarrassment as a working partner at your office.

IBM CORP.

IBM PS/2 Model 80-A31

by Bill O'Brien

With the evolution of the PC into the PS/2 series long done, IBM has spent the last few years refining the capabilities of its new line. The company's latest tower release is the PS/2 Model 80-A31, and its inauspicious name belies the fact that it is one of IBM's most potent MCA products to date.

There's no solace to be found in the Model 80-A31's hefty $11,795 price tag once you begin comparing it with the other computers in this review. For the money, you receive the usual fare of 4MB RAM, a 120MB hard disk, a 3.5-inch floppy disk drive, and the standard PS/2 complement of motherboard-derived parallel, serial, mouse, and VGA ports. Externally, the Model 80-A31 tower could well be any one of the Model 80 series.

The insides of the Model 80-A31 are awash with the IBM logo. Almost every component you find there is stamped "IBM" or "made for IBM." There are, of course, some exceptions: the Intel 80386-25 processor and the Intel 82385 cache controller. The latter is a VLSI chip that ties the 64K of 25-nanosecond 8 by 8-kilobit processor RAM cache to the carded system memory. The reviewed machine arrived at *PC Magazine* with a 4MB system RAM option installed, for a total of 8MB RAM; this occupied one of two proprietary RAM expansion slots.

Even with the relatively fast cache available to the system, IBM's traditionally conservative approach to computing is evident from the test results on PC Labs' 80386 Instruction Mix and Floating-Point Calculation tests. Overall, despite the potential for outstanding performance, the Model 80-A31 managed to climb only into the middle of the pack, although it did quite well on several tests (Conventional Memory, large-record DOS File Access, and Video BIOS Routine Without Scrolling). This is an accomplishment in a marketplace where only two years ago an IBM computer inevitably trailed nearly every competitor. Yet the uneven performance speed is hard to reconcile with the Model 80-A31's high price.

Tradition takes a short holiday at the hard disk. A SCSI controller bearing an Adaptec chip handles disk tasks. Designed as a bus-mastering device, the controller can take advantage of the rapid transfer potential of the MCA interface. The results on PC Labs' large-record DOS File Access test place the Model 80-A31 among the top three computers reviewed. Small-record

IBM PS/2 Model 80-A31
IBM Corp., 1133 Westchester Ave., White Plains, NY 10604; contact your local IBM dealer
List Price: Model 80-041: with 1MB RAM, 44MB hard disk, 1.44MB 3.5-inch floppy disk drive, one parallel and one serial port, mouse port, 8513 VGA monitor, DOS 4.01, $6,145; Model 80-A21: with 4MB RAM, 120MB hard disk, 8515 VGA display, $11,645; Model 80-A31: with 8MB RAM, 320MB hard disk, $16,140.
In Short: The IBM PS/2 Model 80-A31 seems to have been built with one purpose in mind—to transfer large amounts of data to and from the hard disk quickly. Because of that ability and its steep price, it can best be put to use as a network hub.

CIRCLE 545 ON READER SERVICE CARD

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CIRCLE 232 ON READER SERVICE CARD

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Std. plotter emulation	✓ Yes	No
Font card slots	✓ 2	1
Std. input paper tray capacity	✓ 200	50
Std. output paper tray capacity	✓ 100	50
Opt. sec. input paper tray capacity	✓ 500	250
Opt. envelope tray capacity	✓ 75	20
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*Dealer prices will vary.

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For example, if you decide you want faster printing, you can double the LaserPrinter E's speed. Or if your software requires Adobe PostScript® language, it can give you that creative flexibility, too.

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results are far worse, because the drive's 22-millisecond mechanical access time penalizes the excellent transfer rate of the bus and seems slow for a 25-MHz machine. It takes so long to get from track to track that the transfer rate cannot compensate for the delays during short disk operations. An 18-ms. drive or faster, though more daring, would be a better inclusion.

Video quality gets no complaint. IBM's VGA system and monitor are among the best on the market. The video system's performance speed, however, might be a disappointment. PC Labs' video tests indicate that the built-in VGA is tailored toward superfast BIOS operations (as might be expected from the sponsors of OS/2), but the system falls relatively flat when scrolling. Its 3.41-second Video BIOS Routine with Scrolling score still managed to best more than half of the reviewed machines, but given a .66-second time for nonscrolling Video BIOS Routine operations, it should have been better.

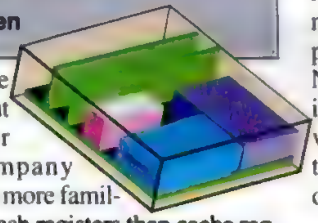
The keyboard, of course, is IBM's own and will be loved or hated according to individual preferences. IBM keyboards have mellowed substantially over the years; while they are still imperfect, the latest crop is far from undesirable. The Model 80-A31 manual, like all IBM manuals, sets a standard for the organized presentation of information.

Offices with limited budgets may choose to look elsewhere for a source of 386 processing power for the individual user. But for duty as a network hub, the IBM PS/2 Model 80-A31 should emerge at the top of the list, thanks to the performance potential that the SCSI controller now wrings from the MCA bus, the controller's own multiple-device-handling capability, and especially the availability of four half-height hard disk bays.

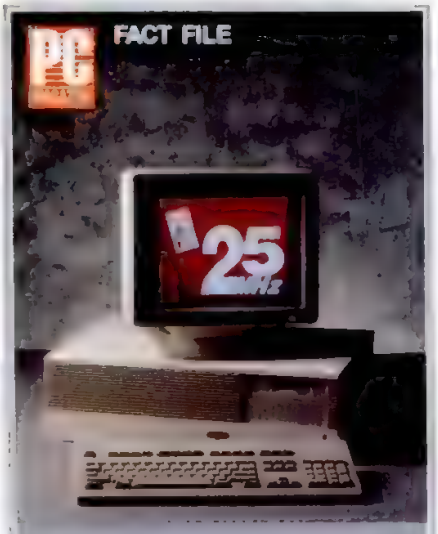
NCR WORKSTATION PRODUCTS DIVISION

NCR PC386

by Bill O'Brien



You might be skeptical about a computer from a company whose name is more familiar to you on cash registers than cache registers, but NCR is quite serious about its computers. If nothing else, the $9,094 price tag on the desktop model submitted for review should make you stand up and take notice.



NCR PC386
NCR Workstation Products Division, 1601 S. Main St., PCD-1, Dayton, OH 45479; (800) 544-3333, (513) 445-2357.
List Price: With 4MB RAM, 100MB hard disk, 1.44MB 3.5-inch floppy disk drive, VGA monitor, one parallel and two serial ports, DOS 4.01, $9,094.
In Short: The NCR PC386 has an extremely high price, but the one-year on-site warranty may justify its inclusion in a corporate buying decision.

CIRCLE 546 ON READER SERVICE CARD

The PC386 is an ambivalent computer by nature. While the drive bays are mounted for a desktop unit, the logo is oriented for a tower. In fact, NCR packs a small toolkit with the PC386—complete with a screwdriver and four massive cork feet—so you can orient it any way you'd like. It's an interesting arrangement.

The heart of the PC386 is an AMI motherboard with an Intel chip set. Processor RAM cache is included and uses AMI's caching controller. The tested machine had 64K of very fast 25-nanosecond static RAM chips in DIP packaging, coupled with the 4MB of 70-ns. system RAM. The PC386 managed to finish about ninth from the top on PC Labs' processor and memory tests. This somewhat lackluster performance is most likely the result of NCR's use of row/column RAM addressing. It's a solid system but doesn't take advantage of the speed tricks permitted by the interleaved and page-mode RAM addressing schemes.

A 100MB Conner hard disk is installed in the box, and it's operated by a noncaching Western Digital SCSI controller capable of juggling seven devices. Its scores on PC Labs' large- and small-record DOS File Access tests, however, indicate that the drive performance is not what we might expect from a peripheral with a $1,695 price tag. In fact, the drive was one of the slowest two we reviewed.

Video offers no triumph for the PC386 either. Despite the Paradise VGA Plus chip set powering the NCR proprietary 16-bit video card, the results on our video benchmark tests were decidedly slow. But if speed is lacking, looks are not. The card produces sharp images, and the 14-inch-diagonal screen was a welcome extravagance compared with the 12-inch and 13-inch monitors supplied with many of the other systems. And while it is a subjective opinion, we felt the NCR/TUV keyboard had just the right combination of resistance and travel to make typing a breeze.

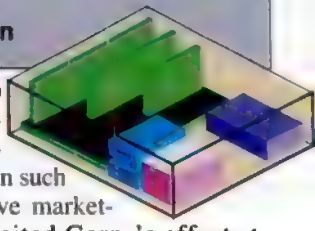
Some perspective is important when evaluating the PC386, since NCR, as a business entity with considerable clout, is not to be classified as just another clone seller. NCR sells to a select clientele who are already familiar with the NCR product line. They are willing to spend a premium on equipment for the value added by the NCR name. In the case of the PC386, that additional support includes a one-year warranty that provides on-site service. In many environments, that commitment to service can be more important than high-speed operation.

Despite the extremely conservative performance of the PC386 and the rarified atmosphere of its pricing, you may well appreciate NCR's commitment to service. If so, you will also appreciate the PC386.

PAN UNITED CORP.

Pan United PC 386/25 Cache

by Bill O'Brien



There is no shame in creating an economy of design. In such a price-sensitive marketplace, Pan United Corp.'s efforts to squeeze every penny's worth of performance out of every dollar spent should be commended. Witness the PC 386/25 Cache computer. Without looking at the label, this 6.25- by 21- by 16.5-inch desk-

top unit could easily pass for a "true blue" AT. Even its $3,880 list price (for our standard configuration) harkens back to a time when computers, even high-end 80386 machines running at 25 MHz, arrived without a premium attached to the sticker.

Inside the box there's no confusion at all. The PC 386/25 Cache is built around a DataTech motherboard using a VLSI chip set. Its rather plain name derives from the 25-nanosecond static RAM chips used as processor RAM cache. The tested machine arrived with 64K installed and can be expanded to 256K by replacing the 64-kilobit chips with larger versions.

These fast cache chips, combined with the installed 4MB of 80-ns. system RAM arranged in page mode, catapulted the PC 386/25 Cache to a position near the top of all computers included in this review. Its processor benchmark test results are certainly outstanding for a machine at this price level.

The PC 386/25 Cache's hard disk performance was less than spectacular if you consider all of the other contenders, but the slow Seagate 4144R RLL drive put up a respectable showing on our DOS File Access tests. There is no caching on the hard disk controller, and the interface used is no more exotic than the standard RLL technology that the Western Digital controller allows. Pan United is relying on the inherently faster access rate for RLL drives, where a higher sector-per-track density can cut read/write head movement by anywhere from 40 to 60 percent. Given its relatively low-tech nature when competing against more-costly ESDI and SCSI opponents, the drive gets passing marks.

Without a label, the PC 386/25 could easily pass for a "true blue" AT.

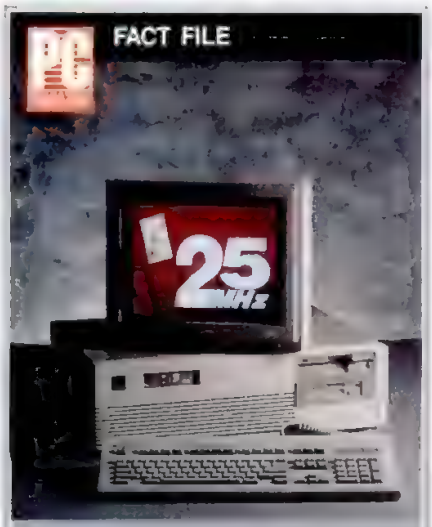
There's no drop in visual quality from the FastWrite VGA card and Samsung Sync Master II monitor. The VGA card is a Video 7 creation powered by a Video 7 BIOS. It is certainly not the fastest display system in the group. The video BIOS chalks up undistinguished scores on our benchmark tests, but the system adds only $735 to the basic-configuration price.

The PC 386/25 Cache was supplied with a Chicony 101-key keyboard that is a personal favorite, with a moderate amount of resistance and a mechanical audible feedback from the key switches.

With prices this low, there has to be some corner-cutting, and the most obvious area is in documentation. Pan United includes an information-packed manual for each peripheral you order with the machine, but the manuals are not quite up to typical readability levels. The system manual is amateurish when compared with the slicker offerings from the major players; it appears typewritten and photo-offset, and it is rife with typographical mistakes.

Naturally, if quality manuals are a concern, you will not appreciate the PC 386/25 Cache. Of course, the price differential between this computer and machines performing at comparable levels should leave you with enough capital to buy more than a few quality books. For a spare system at home to polish off your leftover office work, the PC 386/25 Cache could be difficult to bypass.

FACT FILE



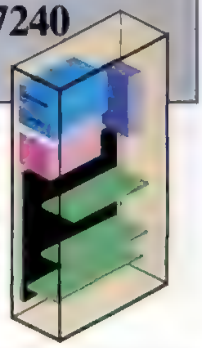
Pan United PC 386/25 Cache
Pan United Corp., 1967 Route 27, #12, Edison, NJ 08817; (800) 433-3006, (201) 906-8044.
List Price: With 1MB RAM, 1.2MB 5.25-inch floppy disk drive, one parallel and one serial port, $1,895; with 4MB RAM, 120MB hard disk, VGA monitor, DOS 4.01, $3,880.
In Short: The limited documentation could prove frustrating for first-time users, but as a backup system to handle work overflows—or a home system for the budget-conscious—this is a major contender.

CIRCLE 547 ON READER SERVICE CARD

PAOKU INTERNATIONAL CO. LTD.

Myoda MD7240

by Bruce Brown



Need lots of drive space? PaoKu International Co.'s Myoda MD7240 comes in a tower case with room for six half-height hard disk, floppy disk, or tape drives. Otherwise, this is a standard mixed-component system; its stately 24.25- by 7.5- by 17.5-inch case is its most striking feature.

The Myoda is assertively priced. Our standard configuration, with 4MB RAM, a 123MB 28-millisecond Seagate RLL hard disk with a Western Digital floppy/hard disk controller, 64K RAM cache, and two Toshiba floppy disk drives (one 1.2MB and one 1.44MB), lists for $3,499. The system also includes a Quimax VGA color monitor and a house-brand Myoda 16-bit VGA video adapter card with Gemini chip set and both 9- and 15-pin ports, plus a BTC 101-key keyboard and DOS 4.01.

The tested machine's I/O ports were on a card on the motherboard, with a basic complement of a parallel port, a serial port, and a game port. A second serial port costs $15. A tinted-plastic sliding cover conceals a set of front-mounted power, reset, and turbo switches, as well as the system keylock and a digital LED indicator of system clock speed.

Inside the Myoda you'll find an AMI motherboard holding the 25-MHz processor. You can also run the system at 8 MHz or 20 MHz if your software demands slower operation. AMI manufactures the ROM BIOS chips with setup in ROM and with switchable system and video ROM shadowing. The nonexpandable 64K RAM cache uses 25-nanosecond chips and is controlled by discrete logic circuitry built into the motherboard rather than on a separate caching controller. This motherboard has a slot for an Intel 80387-25 math coprocessor but is not compatible with a Weitek coprocessor chip.

All RAM in the Myoda system is installed on a memory board that fits in the computer's single 32-bit expansion slot. Using 80-ns. DIP chips, you can expand the total system RAM to 16MB. In addition to the 32-bit slot, which is always occupied, there are two 8-bit and five 16-bit

slots. With three slots used by the video adapter, drive controller, and I/O card, there are four slots free for other expansion cards.

The Myoda can hold up to six half-height storage devices, with four accessible from the front for removable media. The system power supply, which produces a peak of 200 watts, comes with only four power leads. If you plan to install six drives, you'll have to specify a different power supply or use Y connectors, which are simple line splitters. It's fine to split the power leads if the two plugs go to floppy disk or tape drive units, since those devices run one at a time, but don't chance splitting power leads to hard disk, which require constant steady power.

FACT FILE

Myoda MD7240
PaoKu International Co. Ltd., 1053 Shore Rd., Naperville, IL 60563; (800) 562-1071, (708) 369-5199.
List Price: With 4MB RAM, 1.2MB 5.25-inch floppy disk drive, one parallel and one serial port, game port, $2,199; with 123MB hard disk, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, VGA monitor, two serial ports, DOS 4.01, $3,499.
In Short: This tower-case computer is priced well, and the company offers average service and support policies. The benchmark test scores are generally within an acceptable range yet somewhat below average. The machine is passable but nothing to get too excited about.

CIRCLE 548 ON READER SERVICE CARD

The Myoda obtained mixed results on the PC Labs' benchmark tests. Viewed from the larger perspective of all personal computer systems on the market, this machine certainly fits in the fast 25-MHz 386 niche. Within the 25-MHz group, however, the Myoda is a somewhat below-average performer. Its best result was on the Conventional Memory test, where the Myoda was tied for second place. On most other significant tests, the system's scores fall closer to the median mark, with more scores below the midline than above.

PaoKu sells through dealers and directly via mail order, and a 15-day money-back guarantee takes effect on the day you receive the system. Shipping charges are based on the actual cost rather than flat-rate assessment. The standard warranty is for one year and covers all parts and labor, but there is no on-site service contract. If you need service you must return the computer either to the dealer or to PaoKu's facility in Naperville, Illinois.

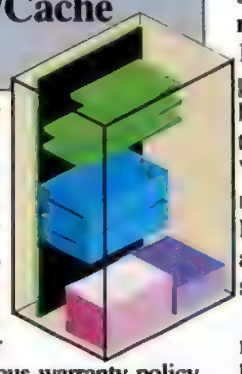
There's no reason not to like the Myoda MD7240. The system includes standard parts in a sturdy case with one more drive bay than average. The benchmark test scores are a little low, but that's not a big problem; it's still a respectable machine. The Myoda's price is also reasonable, given the components included.

The service/support mix is about average, though that's an area where PaoKu may need to be more aggressive to compete with better-known mail-order houses. The company's service profile would be improved with a standard on-site service deal, which is reportedly in the works and may be in place by the time this issue goes to press. The Myoda MD7240 doesn't stand out in the crowd; instead, it fits in nicely, with the kind of parts and performance it should have in this price range.

POLYWELL COMPUTERS INC.

Poly 386-25/Cache

by Bruce Brown



Here's a computer you'll be proud to have on or beside your desk. Polywell Computers' Poly 386-25/Cache is good-looking, fast, and a relative bargain. When you consider the company's generous warranty policy, the deal looks even better.

Our tested system came loaded with options but still carried an appealing price. The standard configuration's $3,565 price tag includes 4MB RAM, a 100MB hard disk, a TEAC 1.2MB or 1.44MB floppy disk drive, DOS 4.01, and a power supply with two cooling fans. Two serial, one parallel, and one game port are standard. Our test system ($4,800) included a CDC 155MB 16-millisecond hard disk with a 32K RAM cache, an UltraStor ESDI floppy/hard disk caching controller, an additional floppy disk drive, an Intel 80387-25 math coprocessor, and a Focus Electronic 111-key keyboard with a solar or AC-powered calculator (eight-character LCD). The video setup included with either configuration is a house-brand color VGA monitor (with 1,024 by 768 maximum resolution) and a TrueTech 16-bit HiRes VGA video adapter with both 9- and 15-pin connectors. This is a loaded system that still has room for expansion.

The Poly 386-25/Cache comes in a mini-tower case measuring 15.75 by 8.5 by 19.5 inches. The case has a door in front, covering the drive faces, the keylock, the power switch, and the turbo and reset buttons. A window in the door lets you view the green LED system speed display and the power, turbo, and hard disk access indicators. This case is sturdy and cleanly designed.

FACT FILE
EDITOR'S CHOICE

Poly 386-25/Cache
Polywell Computers Inc., 61C Airport Blvd. S., San Francisco, CA 94080; (800) 999-1278, (415) 583-7222.
List Price: With 1MB RAM, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, monochrome monitor, one parallel and two serial ports, game port, $2,085; with 4MB RAM, 100MB hard disk, VGA monitor, DOS 3.3 or 4.01, $3,565; with 155MB hard disk and 32K caching controller, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drive, 80387-25 coprocessor, $4,800.
In Short: The Poly 386-25/Cache combines above-average performance, a killer price, and a terrific warranty in an impressive mini-tower package. Look closely here.

CIRCLE 549 ON READER SERVICE CARD

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CIRCLE 525 ON READER SERVICE CARD

The Poly 386-25/Cache uses a 25-MHz processor with a Chips and Technologies 386 chip set and an Intel 82385 cache controller for the 32K of 25-nanosecond RAM cache. The Orchid motherboard uses AMI ROM BIOS chips and has a slot for either an 80387-25 or Weitek 3167 coprocessor chip; with an adapter, you can install both coprocessors together. The AMI BIOS has setup in ROM and lets you select system BIOS and video ROM shadowing, each of which can be enabled or disabled independently.

The system components obviously work well together, since the Poly scored slightly above average on PC Labs' benchmark tests. The Conventional Memory score was the fastest among the machines we tested, but the video Direct to Screen test score was one of the slowest four. Apart from these extreme scores, the machine's results were all close to the mean, with most in the top half of the distribution.

Our tested machine, with 4MB RAM, filled in 16 slots on the motherboard using 80-nanosecond 256K SIMMs. You can build the system up to its 16MB maximum by installing 1MB SIMMs instead of the 256K units. At latest report, Polywell charges $130 for a 1MB expansion chip set. There's a problem with the system as configured, with all sockets full of 256K modules: if you want to increase the memory, you'll need to replace some of the modules already installed, and unless you specify 1MB SIMMs at the time of purchase, you may have to swallow the price of some 256-kilobit chips. There's not much of a market for used memory chips. Fortunately, you don't have to replace all of them, since the Orchid motherboard is perfectly content to have 256K and 1MB memory modules coexist. If you think you'll want to go beyond 4MB in the future, start with 1MB memory modules.

There is room for five half-height drives in the Poly's mini-tower case, all of which face the front and can use removable media storage devices. Our test unit, with the TEAC 1.44MB and 1.2MB floppy disk drives and a full-height CDC hard disk, left room for one more half-height device. The 200-watt power supply has just four power leads, so if you plan to use five devices you'll have to split the lead going to the two floppy disk drives.

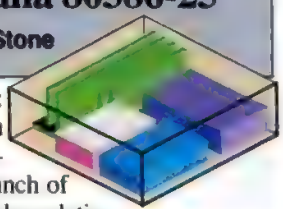
Polywell sells three-quarters of its computers through dealers and the rest directly. Shipping charges are assessed based on actual cost, not flat rates, and there's a 30-day money-back guarantee. Polywell's unique warranty covers all labor for five years, motherboard parts for two years, and all other components for one year. If you need to send the machine in for repair, ordinarily you must return it to the dealer or to Polywell's California facility and pay for shipping one way. A $75 one-year on-site service contract is available in all 50 states and Canada.

You don't have to buy a Polywell system as loaded as our test unit; if you equip it with a more standard lineup of components, the price is within the range of the half-dozen least expensive brands. If I were buying one, however, I'd want it equipped just like our test unit, perhaps with a 150MB half-height tape drive in the remaining drive bay. That would put the total system price over $5,000, but it would still be a monster unit at a competitive price. Good job, Polywell.

STAR INDUSTRIES INC.

Americana 80386-25

by M. David Stone



Today's quiz: How do you define Americana? Is it a bunch of quaint collectibles relating to American folklore? A Norman Rockwell painting? How about a high-tech product like a 25-MHz 386 computer? If you picked the computer, stay away from antique stores, but you should feel comfortable with the Americana 80386-25 from Star Industries.

One of the strong points of the Americana is the low price: $4,239 for our standard configuration. The basic configuration, at $2,299, includes 1MB of RAM, your choice of a high-density 5.25-inch or 3.5-inch floppy disk drive, a Hercules monochrome graphics card and monochrome monitor, one parallel and two serial ports, DOS 4.01, *Dr. Halo III*, utility software, and a mouse. Add a hard disk, and you can have a usable system for under $3,000. Our test unit arrived with 4MB RAM, a Conner 104MB hard disk, a Hercules VGA card, and a GoldStar VGA color monitor, and still bore that perfectly reasonable $4,239 price tag.

The small-footprint case for the Americana 80386-25 measures 6.75 by 17.25 by 16 inches. That leaves enough room for one full-height 3.5-inch drive bay and a stack of three half-height 5.25-inch bays. The review unit came with one high-density 5.25-inch floppy disk drive and with the 3.5-inch hard disk mounted in a 5.25-inch bay. One half-height 5.25-inch bay and the 3.5-inch bay were still available.

Americana 80386-25
Star Industries Inc., 7655 E. Redfield, #10, Scottsdale, AZ 85260; (800) 7827-286, (602) 483-1536.
List Price: With 1MB RAM, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, monochrome monitor, one parallel and two serial ports, DOS 4.01, *Dr. Halo III*, mouse, $2,299; with 4MB RAM, 104MB hard disk, VGA monitor, $4,239.
In Short: The Americana 80386-25 lacks RAM caching and the performance that would go with it, but the system offers a relatively low price, a small-footprint design, and two years' on-site service.

CIRCLE 550 ON READER SERVICE CARD

The Americana's PAT 386 Plus motherboard, from TMC Research Corp., offers a typical eight slots, with five 16-bit slots, one 8-bit slot, and two proprietary slots for TMC Research memory boards. The memory slots can also be used as 8-bit slots. All RAM, however, goes on the memory boards, so at least one slot is unavailable for other purposes. The memory board supplied with the review unit can take up to 8MB of DIP-type RAM, which means the maximum capacity is 16MB using two such boards. Other boards are available, including a single SIMM board that can hold the entire 16MB maximum of system memory. The tested unit had 4MB of 80-nanosecond RAM installed.

In addition to one memory slot, the review unit had three of the 16-bit slots filled, and the lone 8-bit slot held the Her-

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cules VGA board. Two 16-bit slots were occupied by a Silicon Valley Computer IDE controller for the Conner hard disk and Star's own serial/parallel board. The second serial port, connected to the serial/parallel board by ribbon cable, took up yet another slot, leaving only two 16-bit slots free (plus the second memory slot).

Also on the motherboard of the tested system were the 80386 with AMI BIOS and Chips and Technologies chip set, and a socket for either an 80287 or 80387 coprocessor. The coprocessor socket can be controlled separately, so you can install a chip of any speed up to 25 MHz. This feature will probably be of interest only if you're primarily concerned with saving money.

Notable for its absence in the system is RAM cache. This certainly helps minimize costs, but it has the same effect on performance. On PC Labs' processor and memory tests, the Americana 80386-25 was the very worst performer. In fact, it turned in consistently poor performance on all the benchmark tests, coming in dead last on two out of three video tests, and well below average on the disk tests.

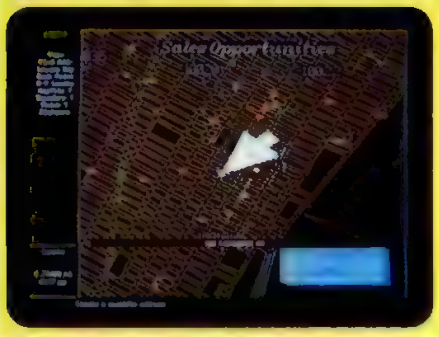
Despite the lackluster performance, the Americana 80386-25 offers some compensating convenience features. The most notable is the digital display panel on the front of the system. The panel consists of an eight-character display and eight membrane buttons that are labeled with both words and numbers. The display normally shows the time but can show other information as well, displaying the date when you push the Date button, the system speed when you push the Speed button, and so on. The panel also includes the Reset button, and it functions as a combination lock for locking out the keyboard.

Another plus is the system's quality construction, with a case that slides on and off without jamming and a chassis that provides rigid support for the motherboard. And Star provides an even more important kind of support: two-year on-site service, coordinated through Star and provided by TRW or GE.

If you're looking for the best performer regardless of price, the Americana 80386-25 is obviously the wrong system. But if you simply want a true 80386 system and are more concerned with price than performance, the Americana 80386-25 is a compact, cost-cutting package that just might fill your needs.

The numbers outside.

See Your Data*



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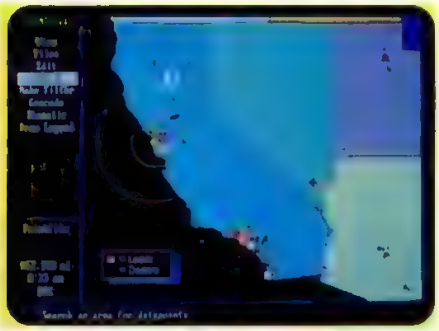

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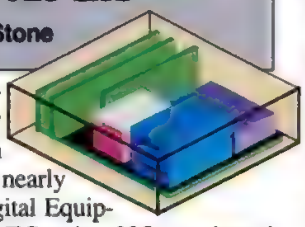
CIRCLE 291 ON READER SERVICE CARD

TANDY CORP.

Tandy 4025 LX

by M. David Stone



The small-footprint Tandy 4025 LX from Tandy Corp. is nearly identical to Digital Equipment Corp.'s DECstation 325c, reviewed earlier in this issue. These two systems share most of the same features, though they are built on separate production lines and differ in options, pricing, and some details.

Our standard configuration bears a list price of $8,845.80 (where a roughly comparable DECstation 325c would cost $8,110). A basic configuration ($4,999) would include 2MB of RAM, one high-density 3.5-inch floppy disk drive, a Tandy 16-bit VGA card, one parallel and one serial port, a mouse port, and assorted setup and utility software. The standard configuration, which we tested, added 2MB of RAM, a Miniscribe 150MB ESDI hard disk and Western Digital controller, a VGA color monitor, and DOS 3.31. This unit had a lower-capacity hard disk than the DECstation 325c, and only one floppy disk drive, which explains why it was somewhat less expensive.

The Tandy 4025 LX shares almost all its physical features with the DECstation 325c, from the quality construction and the modified passive-backplane design to the two 3.5-inch half-height drive bays and one 5.25-inch full-height bay. Our tested system, with one 3.5-inch drive installed, still had room for both a 3.5-inch and a 5.25-inch half-height device.

> The Tandy 4025 LX shares almost all its physical features with the DECstation 325c, including the quality construction and the modified passive-backplane design.

In the 4025 LX review unit, two of the six 16-bit slots were occupied by the VGA card and the ESDI controller. The 4025 LX has an IDE connector on the motherboard, but Tandy's highest-capacity IDE disk option is 80MB. The unit's 4MB of RAM came on two memory boards stocked with 16 256K SIMMs, using 100-nanosecond chips.

One notable difference between the Tandy and Digital systems is the price of options. For example, Tandy charges $99.95 for the second memory board without RAM, about $80 less than DEC. Similarly, Tandy charges about $50 less than DEC for a 2MB upgrade kit. But keep in mind that Tandy's prices are firm, while DEC's prices leave room for discounts from any of its dealers.

Another difference between the machines is that Tandy's 16-bit VGA card is a standard component in the Tandy system; it's optional in the DEC system. And be aware that Tandy's list of hard disk options stretches somewhat longer than DEC's,

Tandy 4025 LX
Tandy Corp., 1800 One Tandy Center, Fort Worth, TX 76102; (817) 390-3011.
List Price: With 2MB RAM, 1.44MB 3.5-inch floppy disk drive, VGA card, one parallel and one serial port, mouse port, $4,999; with 4MB RAM, 150MB hard disk, color VGA monitor, DOS 3.31, $8,845.80.
In Short: Like the DECstation 325c, the Tandy 4025 LX offers quality construction and better-than-average performance, with more drive bays than you would expect in a small-footprint system. The machine also offers a longer list of drive options than its Digital cousin.

CIRCLE 601 ON READER SERVICE CARD

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On PC Labs' benchmark tests, the 4025 LX performed in the top tier on the Video BIOS Routine tests and the processor and memory tests, with scores much like those of the DECstation 325c. Both machines performed well on the large-record DOS File Access test, but only the Tandy 4025 LX was among the better performers on the other hard disk benchmark tests that we ran (at least among those systems without a disk cache).

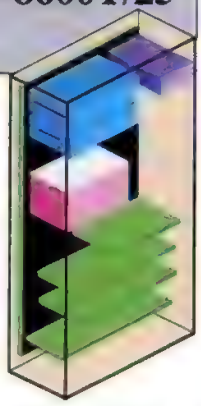
A final important difference is that the Tandy 4025 LX is sold through Tandy's Radio Shack retail stores, with a one-year carry-in warranty. On-site service is also available, though you must be within 150 miles of a Radio Shack service center to allow a technician to visit.

Like the DECstation 325c, the Tandy 4025 LX offers high-quality construction, better-than-average performance, and surprising room for expansion. If you want a small-footprint system, you can live happily with either unit. Choosing between them may be no more difficult than discovering whose service center is closest to your office.

TATUNG CO. OF AMERICA INC.

Tatung TCS-8600T/25

by Bill O'Brien



Once known primarily for its line of inexpensive color monitors, Tatung is making further inroads into the PC marketplace with its computers as well. The Tatung TCS-8600T/25 is something of an enigma. Despite its superbly designed box and well-chosen components, it delivers rather lightweight performance.

The cover slides off this $5,895 tower to reveal a pleasantly methodical layout. You will see none of the visual confusion that occurs when a manufacturer takes a desktop unit and simply flips it sideways. It appears that the TCS-8600T/25 was designed to be a tower system.

Tatung's homemade motherboard has an 8-MHz bus (switchable to 12 MHz), an Intel chip set, and a Phoenix BIOS. The motherboard comes standard with 32K of processor RAM cache in a static DIP configuration. The chips are rated at a blazing 25 nanoseconds.

These features being coupled with 4MB of 70-ns. system RAM, you'd think

> The cover slides off the Tatung to reveal a pleasantly methodical layout. It was designed to be a tower system.

the TCS-8600T/25 would shoot down most of its competition in PC Labs' processor benchmark tests, but these heavyweight electronic components did not have the anticipated effect. The 80386 Instruc-

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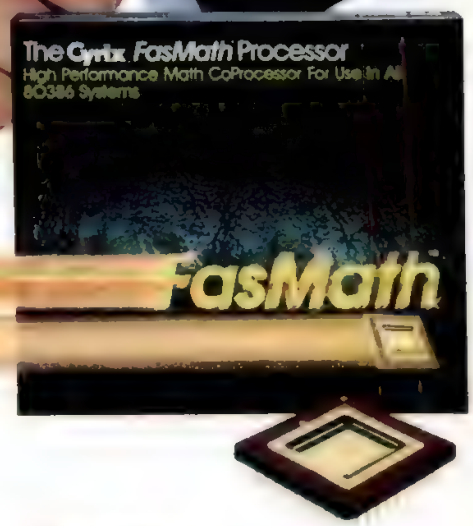

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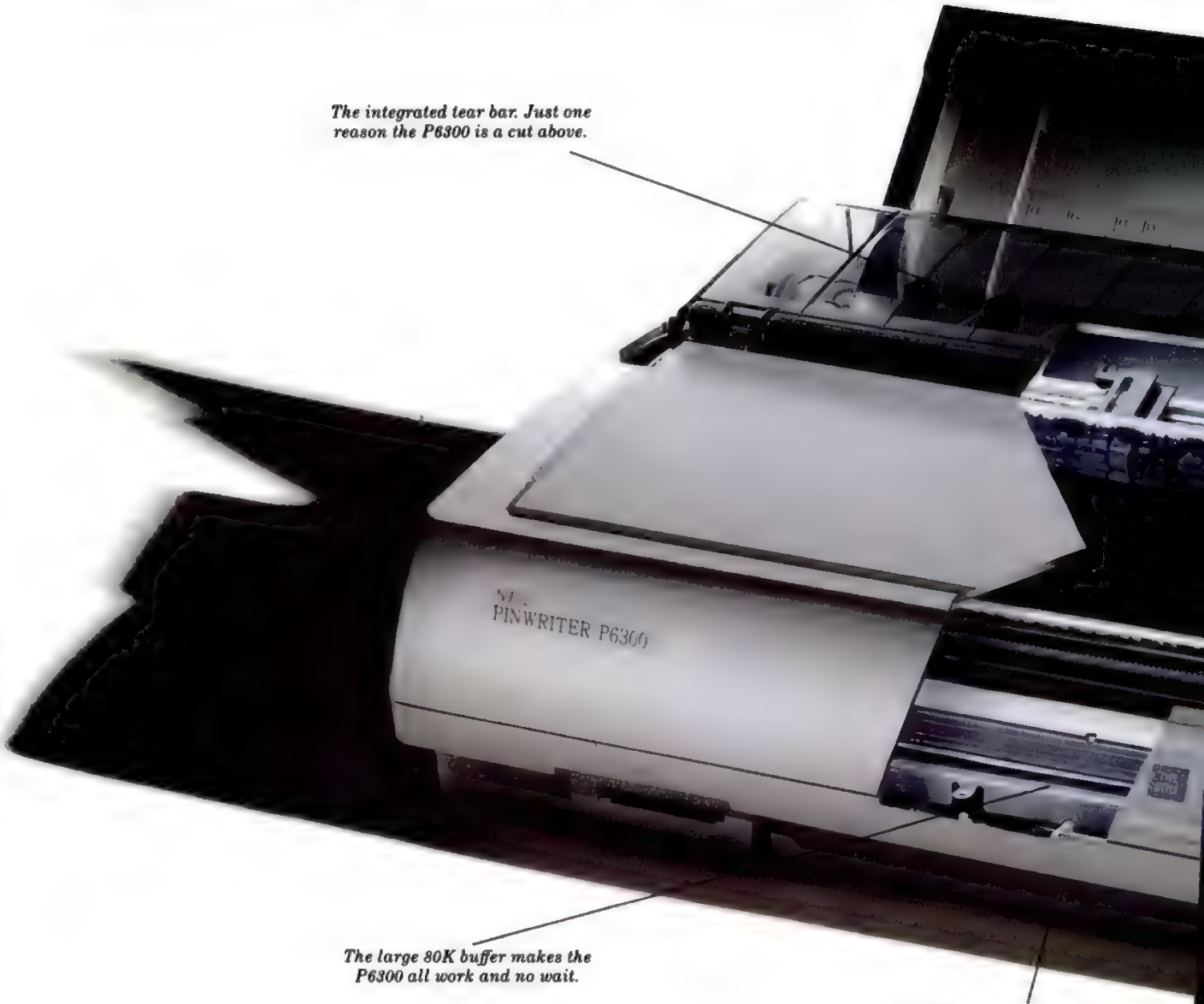

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tion Mix and Floating-Point Calculation test results put the TCS-8600T/25 toward the lower middle class among the reviewed machines.

The monstrously sized Imprimis 329MB hard disk and the DPT hard disk controller, replete with 512K of cache RAM, are largely responsible for the lightning-fast scores on the BIOS Disk Seek and small-record DOS File Access tests. But the results are not as impressive on the large-record test, which exceeds the cache capacity. Once the boundaries of the cache have been broken, the disk drive performance slips down almost to the bottom of the list (despite the drive's 14.5-millisecond track-to-track rating). Upgrading the DPT controller with additional RAM would solve the problem of the small cache, but it would also add a premium of perhaps $1,000 or $1,500 to the price of the system, depending on the amount of cache RAM added.

Tatung TCS-8600T/25
Tatung Co. of America Inc., 2850 El Presidio St., Long Beach, CA 90810; (800) 827-2850, (213) 979-7055.
List Price: With 4MB RAM, 32K cache, 1.2MB 5.25-inch floppy disk drive, one parallel and two serial ports, DOS 4.01, $4,495; with 100MB hard disk, VGA monitor, $5,895; with 329MB hard disk, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, $7,195.
In Short: The performance of the tested system was disappointing in the light of its price. For use in a home office, the basic configuration enjoys a much better price/performance ratio.

CIRCLE 602 ON READER SERVICE CARD

The 16-bit VGA video system is very appealing. The combination of the Tatung monitor and video adapter with the ATI chip set produces well-defined text characters and brilliantly colored graphics. The unit achieves video test scores that are decent for a 25-MHz system, although far from being the fastest.

Despite an intelligently designed front panel with all the controls forward-mounted, a clean internal layout, and what might appear a superabundance of high-tech, high-performance parts, the TCS-8600T/25 falls short of the mark. Its overall speed isn't commensurate with the $7,195 price tag for the tested configuration.

Tatung's 120-day on-site service warranty is an excellent enticement, but this is not enough to counterbalance the TCS-8600T/25's performance. Still, *PC Magazine*'s standard configuration is $1,300 less than the tested unit. While the "standard" system forgoes one floppy disk and substitutes a 100MB hard disk for the 329MB Imprimis, it has a more reasonable price for the level of performance the machine delivers.

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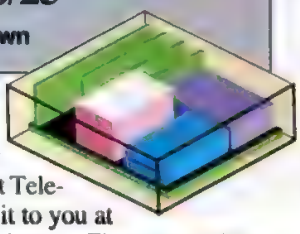
TELEMART

MIT 386/25

by Bruce Brown



Free shipping? Yes, when you buy a computer from the folks at Telemart they send it to you at no additional charge. The actual dollar savings may be only 2 or 3 percent of the total cost, but money is money. And the point is that Telemart recognizes that factors like shipping charges can differentiate vendors in the competitive mail-order hardware world.

Telemart's MIT 386/25 is a conventional collection of brand-name parts. The tested unit had 4MB RAM, a 155MB 16-millisecond CDC hard disk with a 64K RAM cache, an ESDI floppy/hard disk controller, a 1.2MB floppy disk drive, an ATI VGA Wonder 16-bit video adapter and color VGA monitor, one parallel and two serial ports, a game port, and a Monterey International 101-key keyboard. With DOS 3.3, the price is $3,695.

Physically, there's nothing very exhilarating about the MIT. The 6.5- by 21- by 16.5-inch case looks like any AT-style case. The power switch is on the side, but everything else—including the keylock, reset and turbo switches, and system activity indicator lights—is on the front panel.

The MIT didn't perform the fastest on any single benchmark test, but it was faster than average for its class on each of the tests. And a machine with consistently good performance is often more useful than one that screams on some tests and stutters on others.

The heart of the system is its Micronics motherboard. It uses discrete-logic chips for the 386 instruction chip set and uses the well-respected Intel 82835 cache controller chip. The 64K RAM cache uses 35-

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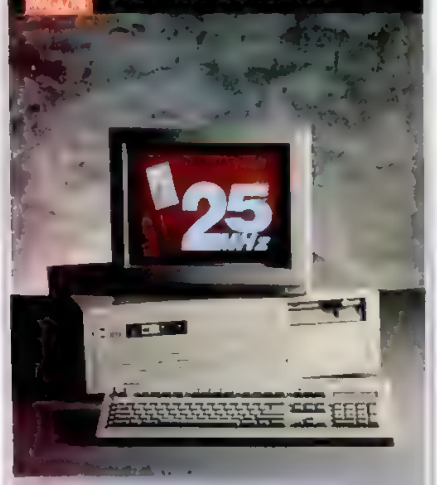

MIT 386/25
Telemart, 8804 N. 23rd Ave., Phoenix, AZ 85021; (800) 426-6659, (602) 944-0402.
List Price: With 1MB RAM, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, one parallel and two serial ports, $1,652; with 4MB RAM, 155MB hard disk, 1.2MB 5.25-inch floppy disk drive, VGA monitor, game port, DOS 3.3, $3,948.
In Short: The MIT 386/25 is a great performer; it comes with good service and support, and the price is right for these components, especially when free shipping is included. This desktop unit gives you a lot for your money.

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nanosecond chips and can be expanded to 128K. The motherboard accepts an Intel 80387-25 math coprocessor or the Weitek 3167. With an adapter board you can install both number-bumpers together.

All regular RAM in the MIT is plugged into a memory card, which in turn is plugged into the motherboard's single 32-bit slot. You can install up to 16MB of 80-ns. DIP chip memory using 1-megabit chips. You can use the setup program or motherboard jumper switches to set the computer to run at 1 or 0 wait states; the latter setting was in effect when we tested the machine. Telemart claims that the 64K RAM cache gives you a 92 percent zero-wait-state hit rate. Raise that to 95 percent with 128K cache.

Other than the 32-bit memory slot, the MIT has two 8-bit and five 16-bit expansion slots, four of which were vacant in our tested machine. The machine has five half-height drive bays, and the 200-watt power supply has four device power leads.

The ROM BIOS is Phoenix Technologies' Version 1.10 10A. The setup program is in ROM, and it includes optional system and video ROM shadowing.

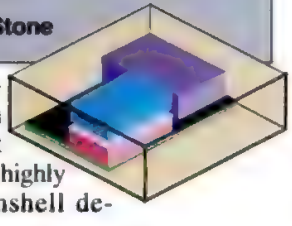
More than any other feature, Telemart's customer orientation sets it apart from the crowd. In addition to the free shipping, it offers a 30-day money-back guarantee, toll-free technical support, and one year of on-site service by TRW. The only glitch is a high 5 percent surcharge if you use the American Express card, so choose another card if you buy from Telemart.

Telemart's emphasis on service and support is reassuring, especially for those who still wonder whether buying a computer via mail order is a good idea. Add Telemart's policies to the MIT 386/25's performance and price and the conclusion is simple: here's a fitting way to buy a computer and a suitable one to buy.

TOSHIBA AMERICA INFORMATION SYSTEMS INC.

Toshiba T8500 Model 25

by M. David Stone



Toshiba America Information Systems is best known for its highly portable clamshell designs. So it isn't overly surprising that the Toshiba T8500 Model 25 shoehorns lots of computer into a small box. Measuring 4.25 by 15.75 by 16 inches, the T8500 is hardly larger than some lunchbox portables—except that Toshiba's 101-key keyboard and the monitor are external to the case.

At $6,998, the standard configuration includes 4MB of RAM, a Conner 100MB hard disk (actually a 104MB disk, but Toshiba claims only 100MB), a 1.44MB 3.5-inch floppy disk drive, a VGA controller on the system board, one parallel and two serial ports, a SCSI port, DOS 4.01, and assorted utility software. All prices include one year of on-site service through TRW, though there may be a charge if TRW has to travel more than 50 miles.

Telemart's emphasis on service and support is reassuring, especially for those who wonder if buying a computer via mail order is a good idea. Here's a fitting way to buy a computer and a suitable one to buy.

Missing from this list of features is a monitor, which would boost the price of the tested system to about $8,500. At this writing, Toshiba has not decided which monitor to offer. Currently available options include a second 100MB hard disk for $1,999 and RAM upgrades at $999 for 2MB or $3,999 for 8MB.

Opening up the T8500 yields a series of surprises. To get to the expansion slots, you remove the right side panel. Inside are three full-length 16-bit slots plus one half-length 8-bit slot. These are mounted on a board that sits perpendicular to the motherboard, walling off the expansion card area from the rest of the system.

There is also a proprietary Toshiba slot that will take cards designed for the 8-bit or 16-bit slot in Toshiba's portables, but you cannot use both the Toshiba slot and the ISA 8-bit slot. The system comes with three ISA-style slot covers on the back panel and one Toshiba-style slot cover. To use the 8-bit ISA slot, you have to replace part of the back panel with a plate that has four ISA-style slot covers. The computer comes with the replacement plate.

Four slots may not sound like enough for a 25-MHz 386 system, but it turns out to be plenty. The electronics and connectors for the video display, floppy disk drive, hard disk, memory, and various ports are elsewhere. And since these basics can use up four or even five slots on an eight-slot system, the four slots on the T8500 are par for the course. In the tested system, all slots were empty, leaving ample room for growth.

Also under the side panel is the system's memory board, which plugs into the motherboard edge-to-edge and comes with the base system. RAM is distributed cre-

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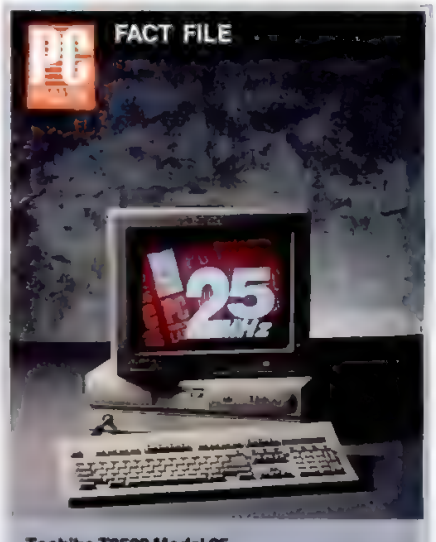

Toshiba T8500 Model 25
Toshiba America Information Systems Inc., Computer Systems Division, 9740 Irvine Blvd., Irvine, CA 92718; (714) 583-3000.
List Price: With 2MB RAM, 104MB hard disk, 1.44MB 3.5-inch floppy disk drive, VGA controller, one parallel and two serial ports, external floppy disk drive port, DOS 4.01, $5,999; with 4MB RAM, $6,998; with 6MB RAM, $7,997.
In Short: Toshiba's T8500 Model 25 offers a small footprint and high-quality construction. The system comes with a 104MB disk and offers room for one more, but it has no other hard disk options. The lack of 5.25-inch bays helps keep the system's size down, but it also restricts disk capacity.

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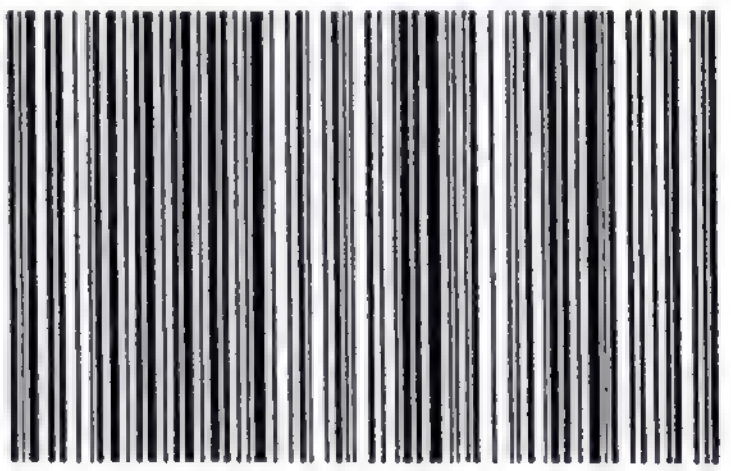

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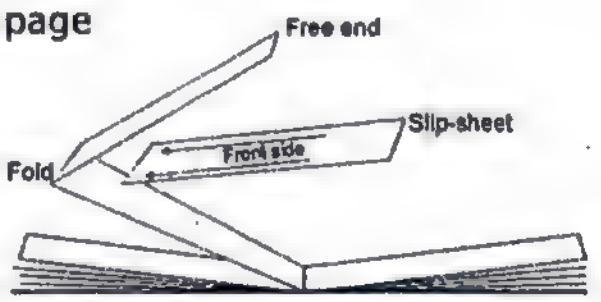

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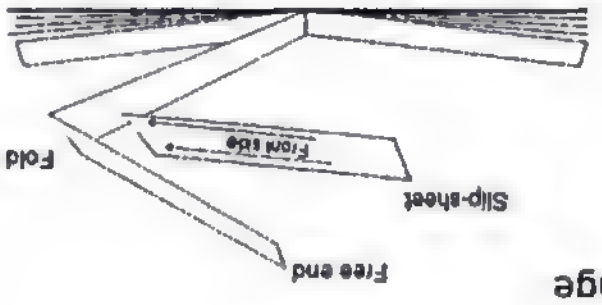

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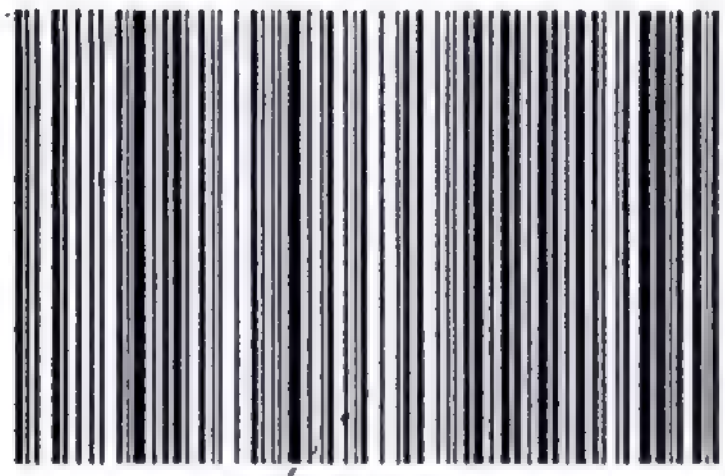

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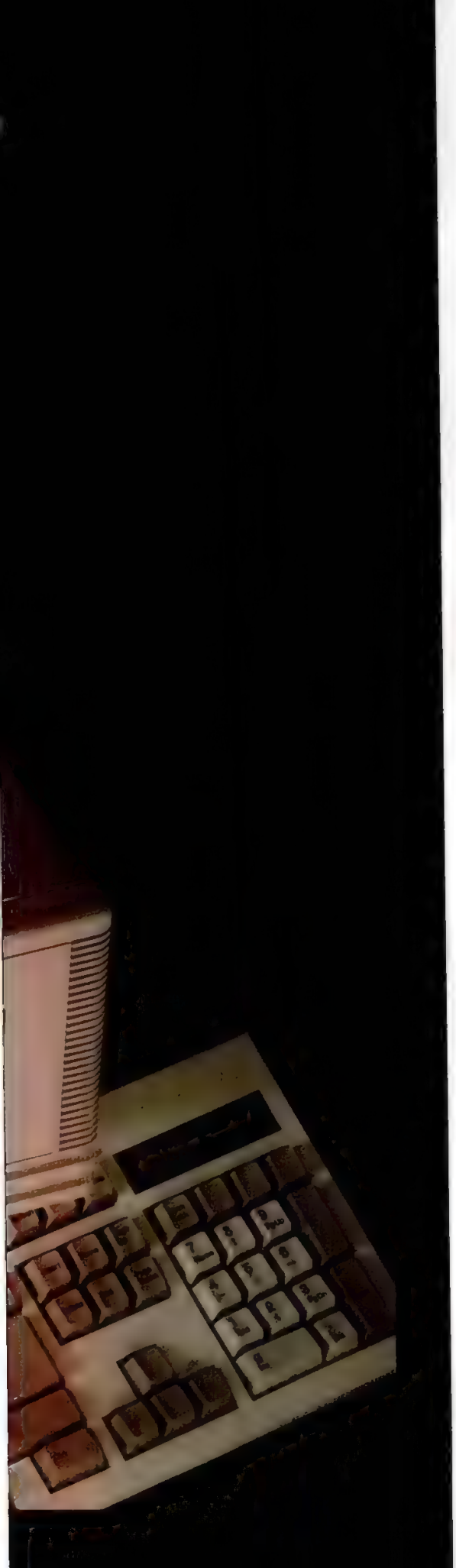

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	Instruction Mix	Floating Point Calculatio
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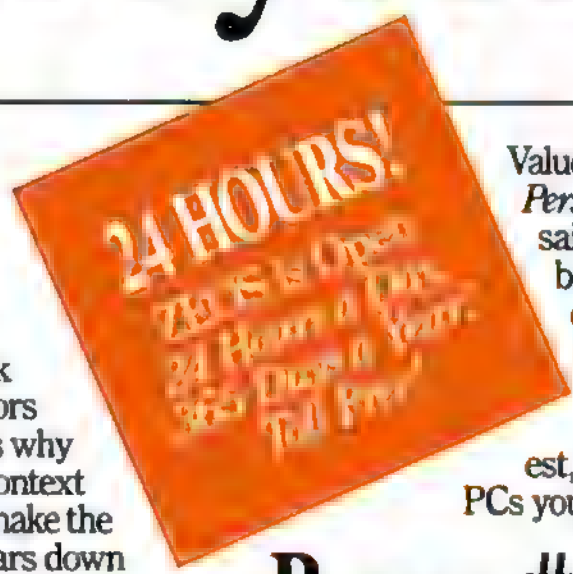

Reason #1

"Overall Excellence."

As *PC Magazine* said "Price is always a consideration. So are benchmark test results. But both factors can be deceiving, which is why we consider them in the context of other aspects that will make the difference months and years down the road."

These are the attributes which *PC Magazine* used in awarding ZEOS the coveted Editor's Choice, not once but four times. And "Overall Excellence" are the very words *PC Magazine* used in describing ZEOS systems comparing them to all others.

Reason #2

Dazzling Performance.

In one recent '386 review, *PC Magazine* awarded ZEOS Editors Choice. "The ZEOS '386 blows away every other computer... a smart choice" is what they said. And in another recent review, *Government Computer News* said the ZEOS 33MHz '386 is "arguably the fastest MS-DOS and OS/2 micro in the world."

Dazzling Performance is built into every ZEOS system. It's a key component of ZEOS Overall Excellence.

Reason #3

Exceptional Quality.

PC Resource Magazine put it this way, "ZEOS ... provides quality comparable with IBM or Compaq and does so for about 70% of the price." ZEOS uses only the very best components. And every system is fully tested and burned-in right in our own labs.

Reason #4

Value.

InfoWorld says, "We find the ZEOS '386 an excellent value. Speed: Excellent. Compatibility: Excellent. Value: Excellent." *Personal Computing* said, "ZEOS...is the best value we've come across...its performance is right up there with the slickest, most expensive PCs you can buy."

Reason #5

Warranties and Guarantees.

ZEOS believes in its products. That's why we offer each and every customer our 30 Day Absolute Satisfaction Money Back Guarantee, no questions asked. Plus, our One Full Year Limited Warranty and Express Parts Replacement Policy. Optional On Site Service is available too. Call for details.

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At ZEOS, the customer is #1. That's why we invented 24 Hour a Day Tech Support. For *your* convenience. If you buy a product from us we feel we should be there to help, any time of the day or night. Give us a call Toll Free! 800-423-5891. Anytime!

Reason #7

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Almost unique in the mail order computer industry, ZEOS maintains its own chip level Research and Development staff. In addition to Systems Manufacturing, we also operate our own Board Level Manufacturing facility.

ZEOS has been involved in Research and Development since our incorporation back in 1981. Our strong and experienced Research, Manufacturing and Technical Staff translates into superior factory direct computer systems for you.

Reason #8

A Sterling Reputation.

In magazine after magazine and review after review ZEOS systems are cited for Overall Excellence, for Excellent Value, as the Right Choice and so on. All of this is flattering but the most important thing is this: What do our customers think? Frankly, they love us. The systems and the support. That means more to us than anything.

Reason #9

Easy to Buy.

ZEOS systems are easy to buy. You can pick up the phone any time of the day or night and order your new ZEOS computer. And we accept MasterCard, Visa, American Express, and Corporate Purchase Orders from Fortune 1000 Companies, Colleges, Universities and Governments. Complete Leasing Programs are available as well.

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a. Your Personal Information

Requested Line of Credit $ _____

Your Name _____ First Initial Last **Date of Birth** _____ Mo. Day Yr.

Present Address _____ Street Apt. # City State Zip

Social Security Number _____ ( ) Home Phone

Date of Residence _____ Month Year **Monthly Payment** $ _____ ☐ Buy ☐ Rent ☐ Other

Previous Address _____

_____ **Dates of Residence** _____ From To

Your Employer _____
(If self-employed, see rear panel.)

Date of Employment _____ Mo. Yr. **Position** _____

Monthly Income _____ Gross $ Net $

Employer's Address _____ Street

_____ City State Zip ( ) Business Phone

Previous Employer _____ **Address** _____

_____ **Dates of Employment** _____ From To

Other Income _____ I have received since (Date) _____
Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as a basis for repaying this obligation.

Monthly Income _____ Gross $ Net $

Name and Address of Nearest Relative Not Living With You _____

_____ Relationship _____

b. Credit Information

Include joint information, if joint account requested.

Bank Account _____ Bank Name ☐ Checking ☐ Savings

Address _____

Bank Account _____ Bank Name ☐ Checking ☐ Savings

Address _____

Bank Loan Reference _____ Bank Name Address

_____ Payment _____ Balance _____

Bank Card Reference _____ Bank Name Address

_____ ☐ VISA ☐ Mastercard Payment _____ Balance _____

(please check appropriate box):

☐ **Joint Credit** with another person. Complete all information.
☐ **Individual Credit** but rely on income or assets of another person as a basis for repaying the credit requested. Complete all information
☐ **Individual Credit** Complete sections "a" and "b" only.

Please complete all appropriate sections, *providing at least two years' residence and employment history.* This will enable your information to be processed as quickly as possible. If you are self-employed, please be sure to complete section "d" below.

Other Credit Card Reference _____ Bank Name Address

_____ Payment _____ Balance _____

Other Credit References _____ Payment _____ Balance _____

Account No. _____ Expires _____

Driver's License No. _____ State _____ Expires _____

c. Joint Personal Information

Joint Name _____ First Initial Last

Date of Birth _____ Mo. Day Yr. **Social Security Number** _____

Address _____ Street Apt. #

_____ City State Zip

Date of Residence _____ Mo. Yr. **Home Phone** ( )

Employer _____

Date of Employment _____ Mo. Yr. **Position** _____

Monthly Income _____ Gross $ Net $

Employer's Address _____ Street

_____ City State Zip ( ) Business Phone

d. Self-Employed Information

Complete this section only if you are self employed.

Business Name _____

Business Address _____

☐ Proprietorship ☐ Corporation ☐ Partnership **Business Phone** ( )

Description of Business _____

Your Position _____ **In Business Since** _____

Your annual income from business _____ **Business' annual income** _____ (gross) (net)

You must provide at least one of the following:

1. Business Bank _____

( ) _____ Telephone _____ Personal Banker's Name

2. Accountant's Name _____

( ) _____ Telephone

3. Financial statement on business attached.

(EXC. AK, & HI)

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atively, with 1MB on the motherboard using ZIP packaging, 1MB on the memory board using DIP packaging, and all additional memory in Toshiba-specific SIMM sockets on the memory board. The maximum total RAM is 14MB. All RAM chips on the tested system were rated at 80 nanoseconds.

Removing the case to get at the system's innards is only a little harder than opening the side panel. A pleasant surprise is that the power supply lifts out easily to let you get at the motherboard sitting below it.

The Toshiba motherboard boasts fine craftsmanship, with lots of VLSI chips and surface-mount technology. Included on the board are the Toshiba chip set, Toshiba BIOS, and an Intel cache controller with 64K of 25-ns. static RAM cache. The board also sports the Paradise PVGA 1A chip, a coprocessor socket for an 80387-25 or a Weitek 3167, and connectors for both a floppy disk drive and an IDE hard disk. The DB-25 parallel port, DB-9 serial ports, SCSI port, and external floppy disk drive port all originate on the motherboard as well.

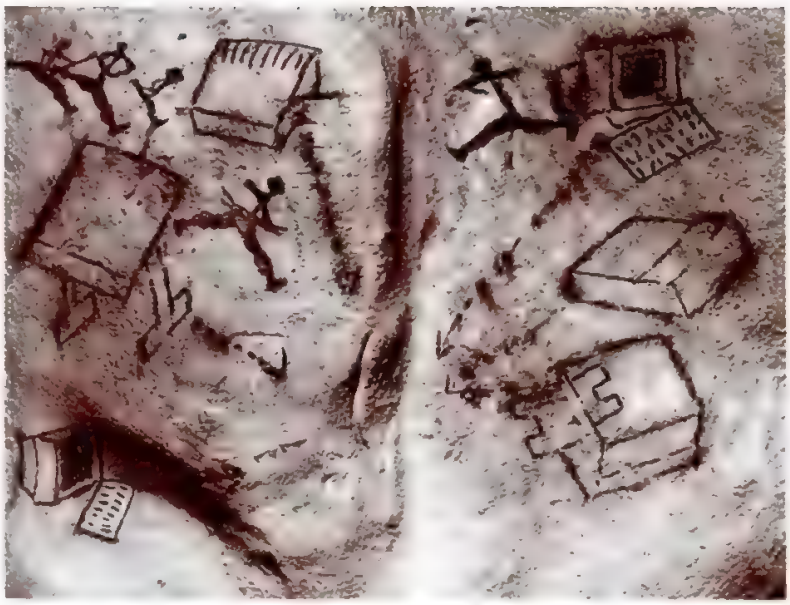
The Toshiba T8500 Model 25 isn't right for the bargain-basement crowd. But if you want a small-footprint machine with high-quality construction, it offers everything except tremendous disk capacity.

The one notable constraint is the limited number of drive bays. Aside from the 3.5-inch floppy disk drive and hard disk in the tested system, there is room for only one full-height 3.5-inch bay in the machine. And to install it you need a drive mounting kit. If you need 5.25-inch floppy disk capacity, Toshiba's only offering is an external 360K drive. And if you need to have a high-capacity hard disk in the 300MB range, there is simply no room for it inside the computer.

The T8500's performance on PC Labs' benchmark tests was less than sterling. Scores were notably better than average on the video tests but relatively poor on the processor and memory tests and not much better on the disk tests. The overall performance is respectable, but you can find better.

At $5,999 for the standard configuration, the Toshiba T8500 Model 25 isn't the right machine for the bargain-basement crowd. But if you want a small-footprint machine with high-quality construction, the T8500 offers everything you're likely to need in a 25-MHz 386 except tremendous disk capacity.

THE MISSING LINK



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A gateway function in pcANYWHERE IV/LAN allows any modem to become a non-dedicated communications server on the LAN. And it works in the background, providing additional flexibility to this easily shared resource

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A hard disk drive's low-level format fades with use. The drive's read/write heads lose their delicate alignment and move away from the original low-level format information. These new data track locations intersect unseen surface defects that were once harmlessly located between tracks. DOS's chilling "Abort, Retry, or Fail ?" message inevitably results. Precious data is soon lost.

If left unchecked, data storage becomes more an act of hope and faith than one of science.

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An act of prevention. Gibson Research Corporation's SpinRite™ software program reads hard-to-read and impossible-to-read data from a DOS hard disk, nondestructively low-level reformats the drive's surface while optimizing the sector interleave factor, analyzes and scrubs each track of the drive for surface defects, and relocates any endangered data to safety. SpinRite easily restores hard disk drives to better-than-new condition with their data intact. Before any data is lost, SpinRite detects that a drive is "softening" then determines and eliminates the cause. SpinRite readily recovers data that the system cannot read.

SpinRite won Byte Magazine's prestigious Award of Distinction and continues to win computer industry praise and acclaim. It has proven itself to be effective in preventing hard disk failure. SpinRite will work for you.

SpinRite II features a detailed technical log, as well as support for DOS 4 and large device driver partitions. It is available immediately from local software retailers or directly from Gibson Research with a 30-day satisfaction guarantee.

Suggested retail price: $89.

To receive additional literature or to purchase SpinRite II, call toll-free:

(800) 736-0637.

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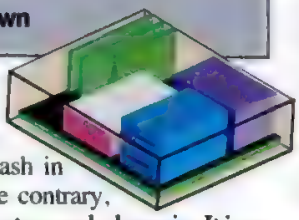
SpinRite II.

A return to science.
An act of prevention.

TRI-STAR COMPUTERS CORP.

Flash Cache 386/25

by Bruce Brown



Tri-Star Computers Corp.'s Flash Cache 386/25 is no flash in the pan. On the contrary, it's a superior system and a bargain. It is an above-average performer, which is always gratifying, but it also has one of the best prices and probably has the best mix of support, service, and customer satisfaction policies of all the computers in this review. Flash nothing! This one shines bright and long.

In its standard configuration, the Flash Cache's $3,364 price includes 4MB RAM with a 64K RAM cache, a 104MB hard disk, a Western Digital 8K buffered floppy/hard disk controller, Mitsumi 1.2MB and 1.44MB floppy disk drives, a 512K ATI VGA Wonderboard 1,024 by 768 video adapter with a ViewPerfect 3 14-

> Tri-Star Computers' Flash Cache 386/25 is no flash in the pan. It's an above-average performer with probably the best mix of support and service policies. Flash nothing! This one shines bright and long.

tional AT-style desktop type, measuring 6.5 by 21 by 16.5 inches. The front of the case has the lock and reset switch as well as LED indicators for power, hard disk access, and turbo speed.

Only two of the system's five half-height bays can house removable media drives such as floppy disk drives or tape drives. Preferable machines have at least three removable media drive bays, so that they can hold both formats of floppy disk drives plus an internal tape drive. However, Tri-Star can configure the Flash Cache for you with other cases, including a tower unit that handles four removable media devices.

The Flash Cache system has a proprietary motherboard with discrete logic circuitry for the 386 chip set and for control of the RAM cache. The minimum RAM

If you can open the box, you have what it takes to link your PCs together.

Even if you know absolutely nothing about PC networking, ChainLink™ provides everything you need to quickly and very easily link together from two to sixteen PCs in your work group. Giving you the flexibility and power to benefit from file transfer, printer sharing, electronic mail, and more. And ChainLink is incredibly inexpensive. You can link together up to four PCs for only $395; eight for just $595; and sixteen for only $795.

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Colin Chilvers prefers that his nightmares show up on the

silver screen, not his computer screen.

When you're an Oscar-award winning Special Effects Director with $20 million on the line, there's one demon you never want to see.

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Because it takes more than talent and money to make a major movie fly. And each of his multi-million dollar productions features vast computer generated data. From script writing and production schedules to shot lists, insurance and crew sheets.

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Printers, Peripherals, Computers, Copiers Typewriters and Facsimiles

Panasonic
Office Automation

P3-PC

cache is 64K of 25-nanosecond chips, but you can expand it to 256K. The motherboard has a single socket that can hold either an Intel 80387-25 math coprocessor or a Weitek 3167. The ROM BIOS is the familiar AMI brand, with setup in ROM and both system and video ROM shadowing options.

Memory consists of 80-ns. 1MB SIMMs. Up to 8MB of the SIMMs can be installed on the motherboard, and then for more memory you need to buy a $175 optional memory board that plugs into the system's sole 32-bit expansion slot. The memory board holds another 8MB, bringing the system maximum to 16MB. Tri-Star sold 80-ns. 1MB SIMMs for $125 each at the time of review.

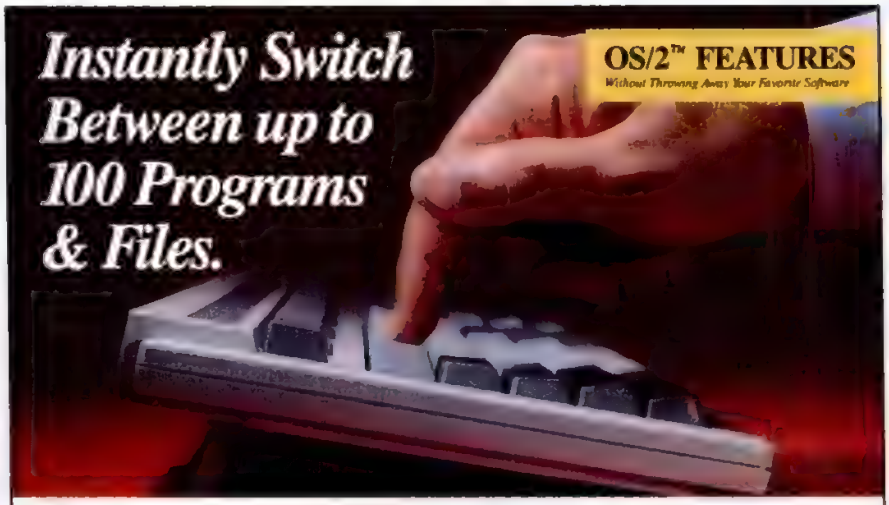
In addition to the 32-bit slot, the Flash Cache has one 8-bit slot and six 16-bit slots. In our tested system five slots were unused. Our unit also had room for two more half-height drives to fill the case to its maximum of five devices. The 200-watt power supply has four power leads for drives.

The hard disk benchmark test scores for the Flash Cache are average for the BIOS Disk Seek and large-record DOS File Access tests, and below average for the small-record DOS File Access test. The other scores are all above average, in varying degrees. In processor scores, the machine was part of a three-way tie for the fastest results on the 80386 Instruction Mix test, and it garnered second place on the Floating-Point Calculation test.

Tri-Star currently sells 10 to 15 percent of its systems through dealers and VARs; the remainder are sold directly. Three years ago this Arizona-based company started selling peripherals and computer supplies but quickly began building systems. It now concentrates on higher-powered 386 and 486 computers, eschewing the 286 world. A division of Tri-Star called Tri-CAD focuses on the CAD market and sells several systems bundled with

Flash Cache 386/25
Tri-Star Computers Corp., 1520 West Mineral Rd., #2, Tempe, AZ 85283: (800) 678-2799, (602) 838-1222.
List Price: With 1MB RAM, 1.2MB 5.25-inch or 1.44MB 3.5-inch floppy disk drive, monochrome monitor, one parallel and two serial ports, $1,895; with 4MB RAM, 64K cache, 104MB hard disk, 1.2MB 5.25-inch and 1.44MB 3.5-inch floppy disk drives, VGA monitor, game port, DOS 4.01, $3,364; with 150MB hard disk, $3,575.
In Short: Above-average performance, a bargain price, and impressive service and support make the Flash Cache 386/25 a highly recommendable machine.

CIRCLE 606 ON READER SERVICE CARD



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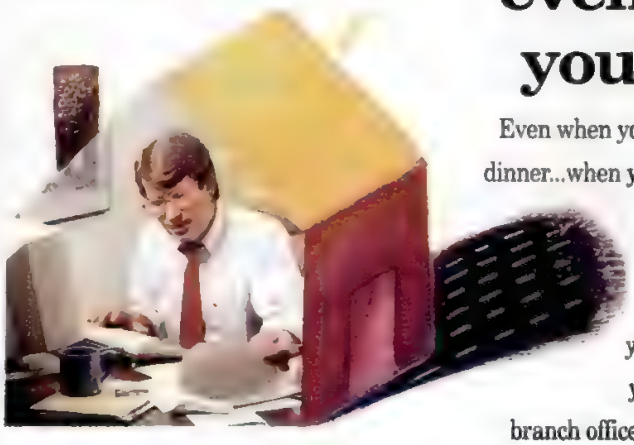

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CIRCLE 735 ON READER SERVICE CARD

accessories like digitizers and math coprocessors for CAD users.

Tri-Star's two-year full system warranty is twice the usual length of time, as is its 60-day money-back guarantee. The company includes a one-year on-site service contract with TRW and offers lifetime toll-free technical support. Shipping charges are individually calculated, which is preferable to a flat fee since in most cases the amount is cheaper. Overall, Tri-Star's array of service and support sets a target for other vendors to aim at.

With good test results, hard-to-beat prices, and a commendable set of customer-oriented practices, it's not difficult to see why Tri-Star continues to grow and to attract additional customers. Take a look at this company's computers—and those of you who work in the CAD environment should inquire about its bundled systems. ■

Tri-Star's two-year full system warranty is twice the usual length of time, as is its 60-day money-back guarantee. Overall, Tri-Star's array of service and support sets a target for other vendors to aim at.

Bruce Brown *is a contributing editor of* PC Magazine *and a computer consultant based in Simsbury, Connecticut.* **Bill O'Brien** *is a contributing editor of* PC Magazine. **Alfred Poor** *is a contributing editor of* PC Magazine *and an industry analyst based in Perkasie, Pennsylvania.* **M. David Stone** *is a contributing editor of* PC Magazine *and an industry consultant specializing in communications and word processing.*

MOVING?

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When considering new computing technologies, remember the importance of compatibility. Weigh the cost of retraining. Bear in mind the investment you've made in your current systems. Don't overlook networking options. Consult with experts and analysts.

Then do what

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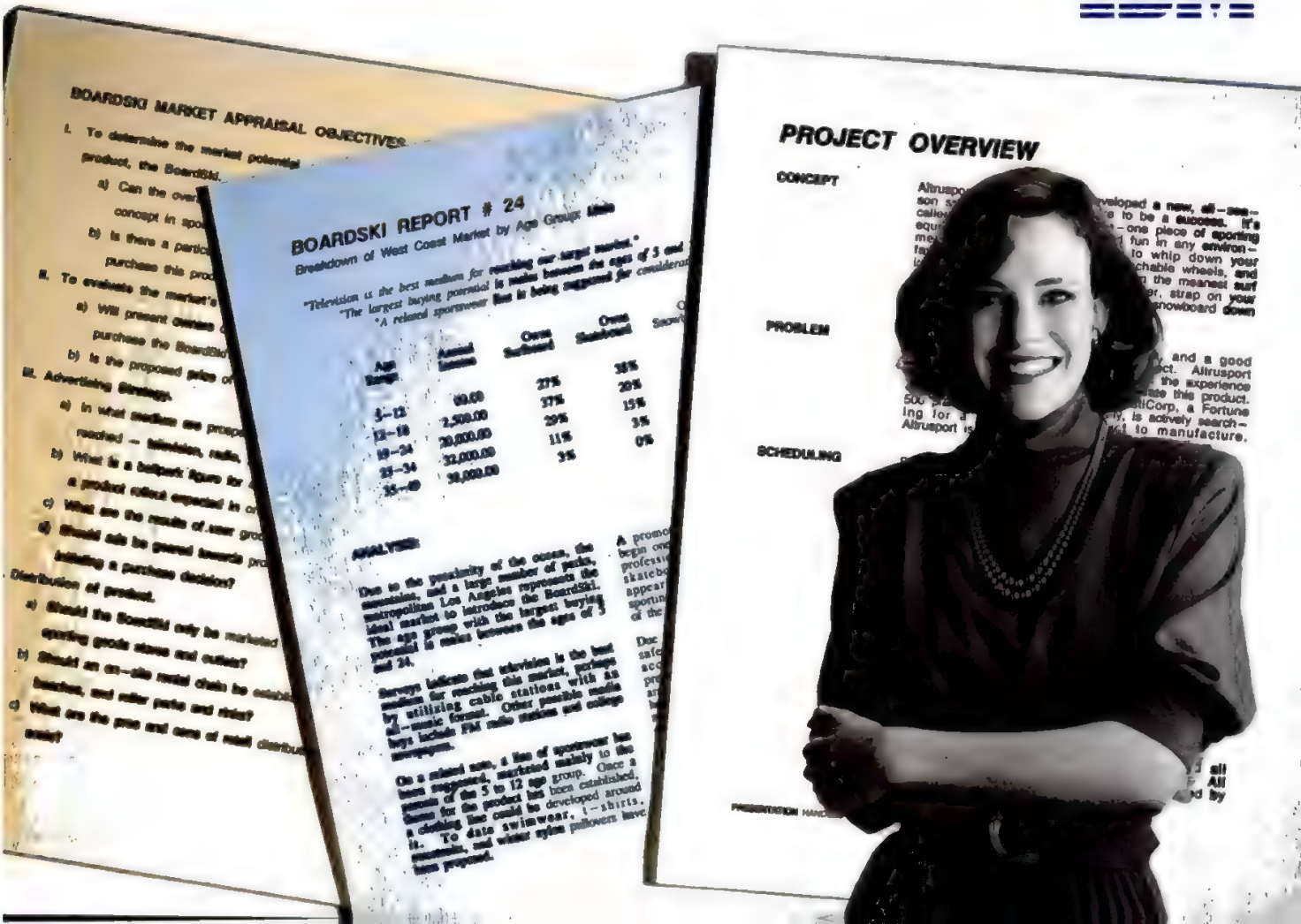


BUILDING WORKGROUP SOLUTIONS

VOICE E-MAIL

With the incorporation of useful new technology into the LAN communications scene, these three voice e-mail systems allow you to play back e-mail messages, transmit voice messages, or verbally annotate a cumbersome spreadsheet for a coworker.

BY FRANK J. DERFLER, JR.

People love to find new ways to communicate. Just when many folks thought or hoped that computers, networks, and electronic mail would produce the longed-for "paperless office," desktop publishing and fax machines gave us all new means of expression and buried us in even more paper.

As the electronic communications systems in our society evolve, they don't displace one another—we just communicate more than ever. Making direct telephone contact hasn't gone out of style, but other electronic means of communication have augmented telephone conversations for many people.

Electronic mail, over local area networks (see "LAN E-Mail: Spreading the Network News," *PC Magazine*, September 26, 1989) or distance-spanning services like MCI Mail or AT&T Mail, is useful for workgroup-wide communications. Voice-mail systems that answer incoming calls, store messages, and forward them on demand often eliminate the need for real-time conversations. And fax has a breezy simplicity that reduces the technical threat implicit in other forms of electronic communications.

Now, a new twist in communications has come to LANs: voice e-mail. This isn't the typical voice mailbox you encounter when you phone people. (For a review of these products, see "Replacing the Receptionist: PC-Based Voice Mail Systems," *PC Magazine*, January 17, 1989.)

Today's voice e-mail products—Artisoft's LANtastic, VoxLink's VoxMail, and Wang's Freestyle System—typically aren't connected to the telephone system, although VoxMail has that capability. Instead, voice e-mail is an augmentation to electronic mail systems; it carries voices, music, and other sounds across a LAN. Products for large commercial mail systems aren't available yet, but there is no reason why this technology can't also apply to MCI Mail, IBM's Profs, and all other types of large electronic mail services.

A TALKING NETWORK

Why would you want to hear voices over your network? Because, as humans, we used verbal expression years before we began writing, and for many people verbalizing is easier and more satisfying than jotting thoughts down on paper. Speaking potentially evokes greater emotion, conveys greater sincerity, and promotes a higher level of trust than writing.

Frequent e-mail users invent symbols, such as the sideways happy face :-), to help others understand written humor. Aside from these artificial means, however, most people have difficulty shading their written words the way they do their speech. Cynical comments that sound humorous in speech can come across as insults in text.

The second—and more practical—answer to the question "Why voice e-mail?" is that there are several interesting applications we can point out today, and even more that creative minds will discover tomorrow. Today's list includes:

- Attaching a verbal explanation to a spreadsheet or report. Wouldn't your spreadsheets "speak for themselves" if people viewing them heard your voice explaining each line of numbers as it scrolled across the screen? You can do this with Wang's Freestyle System. With Freestyle, explanations sound from a speaker as numbers flow across the screen. The Application Program Interface (API) available for Artisoft's LANtastic lets developers build voice capability into their own applications running on any NetBIOS network.

MORE THAN AN EXPENSIVE ANSWERING MACHINE

By M. Keith Thompson

Music CDs started the digital voice revolution, and what followed was a flurry of development in many areas of digital recording—including something as seemingly unrelated as voice e-mail. From mini- to microcomputers, users and developers are finding new ways to use this technology. Still, most people take the way computers handle voice communications for granted.

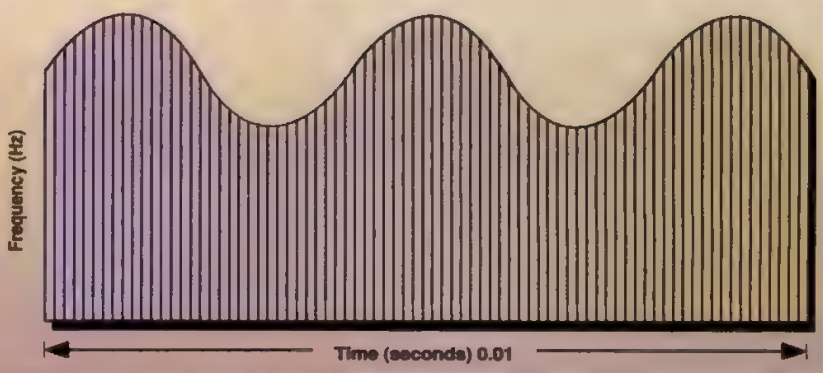
The process is complex, requiring plenty of computing power. Special analog-to-digital and digital-to-analog converters (ADCs and DACs) must transform analog speech to the digital ones and zeros that the computer can understand. Here's how it works: A voice waveform is recorded digitally by a periodic sampling of the waveform through an ADC. The quality of speech that can be generated with this approach varies with (1) the rate at which samples are recorded (appropriately called the sampling rate) and (2) the number of bits the ADC uses to represent a sample (the resolution).

The challenge here is that the analog signal representing the voice is continuous; a computer must find a way to change the continuous waveforms into binary numbers. In digital speech recording, a computer attempts to approximate the speech signal through frequent sampling of individual points in the analog wave with an ADC. It converts that sample into a number corresponding to a percentage of the maximum possible value of the speech signal. The higher the maximum possible number, the lower the error in the digital representation. Likewise, the greater the sampling frequency, the more the digitized speech sounds like human speech.

The computer reconstructs the signal by sending the data to a DAC. The DAC converts the digital data back to analog voltages. Sending the data to the DAC at the same frequency it was recorded results in an approximation of the original waveform. If the accuracy of the ADC's resolution and the sample frequency are high enough, the human

A SOUND SAMPLING FOR VOICE E-MAIL

The diagram at right explains how Adaptive Differential Pulse Coded Modulation (ADPCM) stores speech in binary form. The speech is sampled 8,000 times per second, then each of the 8,000 points is converted to a number associated with the difference of modulation from the previous point. Comparing each new point with the previous point requires only four bits of information instead of the eight bits required for the modulation relative to zero. This conserves disk space by storing half the information. The sine wave represents 1/100 of a second of speech and shows where the 80 samples in time are recorded.



■ Sending quick voice messages across the network to specific persons or to a mailing list. Executives still saddled with keyboard phobia—often a condition of perceived status rather than a neuromuscular limitation—can dictate their thoughts to a PC for transmission.

■ Having your PC read your e-mail messages to you. VoxMail, for example, does text-to-speech conversion. So even messages that aren't created as spoken text can be converted. This capability lets you pace the floor, practice putting, or simply rest your eyes while still receiving your e-mail. Obviously, this is a great advantage for persons with visual limitations.

■ Sending music and other sounds across the network. We have central databases of written words and numbers, and there are databases of images commonly used in security and real estate applications, but the concept of databases for sound is new. Many types of businesses (commercial broadcasting, for example) need the ability to quickly search and retrieve sounds, and then edit and manipulate them in digital form. The products in this review move high-quality sound across a network of PCs. We aren't aware of a database of sounds yet, but all the pieces are here. Someone could create a commercial audio database product in a matter of days.

> Executives still saddled with keyboard phobia can dictate their thoughts to a PC for transmission.

By the way, let us know when the first computer bulletin board service for exchanging music comes on-line—it could grow more popular than 900-number talk lines. Is this the beginning of the end for FM radio?

TOTAL INTEGRATION

Some of the folks responsible for marketing these products paint grand pictures about PCs becoming the central point for all voice, data, and fax communications. They talk about generating messages by local voice, telephone link, keyboard, or fax on one end and receiving the message on the other end(s) in any desired format, regardless of how it was created.

The products we reviewed bring this technology a lot closer, but having the technology and getting people to buy it are two different problems.

Four years ago, the integration of multiline telephone and PC systems as a product idea seemed a natural. At least six companies, Compaq among them, designed sharp looking and highly functional products using the power of the PC to initiate, schedule, queue, and conduct both voice and data communications sessions.

But no matter how great the power of the PC and the multiline telephone might be as standalone devices, these products flopped when companies packaged them together and tried to sell them. Standalone fax machines and multiline telephones lose a lot of appeal when mixed with even the friendliest PC interface, so don't look for total integration of these systems soon.

SOUND TO DATA AND BACK AGAIN

In essence, these products combine voice encoding and decoding with standard electronic mail systems. They all use special hardware, called digital-to-analog (DAC) and analog-to-digital (ADC) converters, to change sound into a stream of digital zeros and ones (see the sidebar "More Than an Expensive Answering Machine"). Modern integrated circuit techniques reduced the price of the components and made designing DA and AD adapters easier than it was in the past. The Artisoft adapter costs $149 each.

ear will have a hard time telling apart the computer-generated voice and the real thing.

One of the most important considerations in designing a voice recording system is the compromise made between the quality of sound produced and the quantity of data required to reconstruct the voice. Higher sampling rates and greater resolutions require more disk space. The total number of bits required to store a message is calculated using the formula: "bits of disk space = sampling rate × resolution × length of message."

For example, a 20-second voice message collected at the typical rate of 8,000 samples per second with a resolution of 12 bits requires 1,920,000 bits, or 240,000 bytes, of disk space. Conversely, the same message at 4,000 samples per second with a 6-bit resolution requires only 60,000 bytes, but it won't sound nearly as good.

For speech reproduction, a sampling rate of 4,000 to 8,000 samples per second and a resolution of 8 bits is adequate for most applications. But storage requirements add up fast. Using the above formula, a 20MB disk stores only 42 minutes of voice.

Fortunately, well-known data-encoding techniques exist to cut down—by a factor of two or more—the number of bits actually stored. The most common technique is Adaptive Differential Pulse Coded Modulation (ADPCM). With ADPCM, instead of storing the complete digital encoding of the speech signal, the only information stored is the difference between the present and the previous sample. By using ADPCM, it is possible to record 8 bits of information in 4 bits.

ADPCM got its name because the analog value associated with the 4 bits stored will vary depending on the magnitude of the previously recorded signal. Even the magnitude of the difference in signals represented by the 4 bits varies depending on previous values of the input signal. The software uses the same algorithm in reverse to output the data for reconstructing the original speech signal.

Various manufacturers implement this process differently. Some, like Dialogic, use the Intel 80188 processor; others, like Natural Micro Systems, use the TI 32010 digital signal processors; and still others, like Artisoft, have no on-board processor but keep costs low by letting the PC do the work.

Each design has its own advantages. When cost is a primary concern, the Artisoft card does a good job with voice, but needs CPU power. An on-board processor design, like Wang's Freestyle System, provides better performance but at a higher price. ■

The size of the data file created by encoding 1 minute of spoken text depends on the sampling rate of the AD converter and the speech rate of the speaker, but for e-mail it is generally around 100K per minute. Higher-quality sound can easily take twice that amount. Once the sound is in digital form, it's easy to play back and edit. You can roll the file back to a particular byte to change pitch, reduce spacing between bursts of sound, and edit sounds in other ways.

Of course, once the text is in digital form you can move it over communications channels and call it into memory just like any other data file. As an e-mail message, the file containing the sound moves across the network just as a database or spreadsheet file does. When it's time for the PC to generate audio from a certain portion of the file (for example, when someone scrolls across a specific cell of a spreadsheet), a simple program reads a portion of the file from disk and sends it to a DA converter. The converter, hooked to a speaker with better volume and sound quality than the one in your PC, gives a faithful reproduction of the input—after any editing.

As you'll see in the reviews, these products have many differences. Wang's Freestyle System requires a dedication to its own software architecture, but it has a long list of unique capabilities. VoxMail has strong potential for mixing voice, fax, and other transmission media. Artisoft's approach is to start the technology blossoming by delivering good performance at a low price.

The integration of sound and text is in its infancy. Now is the time for creative system developers to climb on board and find new ways to sell interesting products.

VOICE E-MAIL: SUITABILITY TO TASK

The voice e-mail systems we reviewed showed more differences than similarities. LANtastic, for instance, is first a network; it offers support for voice e-mail among its other functions. VoxMail becomes the voice component of existing electronic mail systems that support the Mail Handling Service. And Wang's Freestyle interacts with existing applications and allows you to capture, annotate (with handwritten or spoken text), and transmit screens.

But since voice e-mail is the one feature the three products we reviewed do have in common, we provide the subjective ratings below to help you choose which product may be right for your particular needs. Compare them with the product reviews for a complete picture of what each product offers.

THE TASKS

Each voice e-mail package is rated according to its usefulness in four areas that cover the gamut of primary workgroup tasks. The first rating, "Large Workgroup Communications," evaluates how well the product handles various communications used by large organizations. These include communicating with users in your building, across town, or even cross-country.

The second rating, "Integrating Voice with Applications," reflects how well the product attaches voice messages to spreadsheets, word processing files, or databases. Ideally, the application displays the information on the screen at the same time it plays the voice message through a speaker, so, the recipient can more closely follow the flow of data.

The third, "On-the-Road Access," determines how well the product integrates voice e-mail into a business traveler's daily routine. Can the person on the road access these voice messages painlessly?

One product may offer direct communication into e-mail programs, while another sends voice files only as attachments. Thus, the fourth rating, "Integrates into Existing E-Mail Systems," determines how easy it is to add the product's voice e-mail capabilities to your own e-mail system.

Note that in the "Integrating Voice with Applications" category, LANtastic receives the highest possible score for its developers' API. With this package, application developers can create add-in or built-in functions to insert verbal messages in the middle of a program.

THE RATINGS

0—Completely unsuited for the task
1—Poor
2—Good
3—Very good
4—Excellent for the task

Product Name

Large Workgroup Communications	4
Integrated Voice with Applications	3
On-the-Road Access	2
Integrates into Existing E-Mail Systems	1

LANtastic

Leonardo DaVinci might have called it a work of art. If you appreciate fine art, you'll love Artisoft's sleek voice communications system that allows network users to send and receive electronic voice mail.

Artisoft bundles voice mail capability into its LANtastic network operating system (see "Building Workgroup Solutions: Low-Cost LANs," *PC Magazine*, March 28, 1989) and has kept the voice adapter card's price at a low $149. While the voice and LAN systems work well together, you're not required to have one with the other. You could use the voice adapter without the network and transmit files of digitized voice via modem or mail them on disks.

If you choose to buy the LANtastic network operating system including the software to drive the voice adapter card, you can get it in several ways. If you buy a LANtastic starter kit for Ethernet or for Artisoft's proprietary 2-megabit-per-second operating system, you get the LAN adapter hardware and software bundled together.

You can buy the operating system software that will run with many NetBIOS adapters and provide full network services for $495 (prices vary according to the number of users). Every voice-capable PC needs a voice adapter card and the LAN hardware and software.

Software developers who want to integrate Artisoft's voice communications feature into their products can purchase a Voice Programmer's Interface for $195. A set of voice programming system calls makes it possible for programs to use the LANtastic voice adapter card to record and play digitized sound.

LANtastic

Large Workgroup Communications	3
Integrated Voice with Applications	4
On-the-Road Access	1
Integrates into Existing E-Mail Systems	2

"Instead of going to the computer manufacturer for hardware service and to the various software companies for support, you can go to the VAR, who will take care of everything."

Bill Machrone
Editor in Chief
& Publishing
Director
PC Magazine,
October 17, 1989,
Page 67

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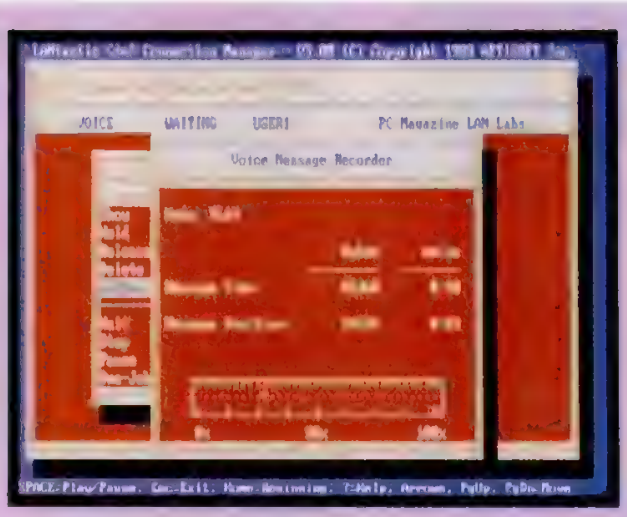
CIRCLE 192 ON READER SERVICE CARD

LOADING THE PACKAGE

LANtastic's operating system isn't difficult to install; you simply load the software and adapter cards into your PC and make sure the necessary card drivers are installed correctly. Electronic messages will guide you through the installation.

The voice e-mail package helps you create, erase, rewind, forward, and pause voice mail messages. You select the voice communications route you wish to take—Mail or Chat—from LANtastic's main menu list; create and send your message; and either pick up your handset or turn on your speaker box. The voice adapter card distributes the voice data through an RJ-11 phone connection located on your voice adapter card.

Artisoft includes a telephone handset with each voice adapter card. While this is the primary way you'll record and play back messages, a separate output jack on the adapter can feed one of the small amplifier/speaker combinations designed for higher-quality sound.



LANtastic uses layers of windows to provide control and maintenance options. The pointer display shows your location in a recording session or during playback. Other windows control the status of recorded messages.

ANALOG TO DIGITAL

The LANtastic voice card translates analog sound into digital format in your PC. The system has an audio bandwidth of 200 to 3,400 Hz—far from high fidelity but slightly better than the best telephone quality. Being a digital system, it avoids the cumulative noise found in standard analog telephone systems.

Once digitized, your data is treated like any other file stored in the PC. You can send it out through a modem or through the e-mail LAN. On the receiving end, another voice card translates the digital file back into sound so the person at the receiving machine can hear the message.

You can opt for a voice-compression mode that reduces the size of your voice files by about 50 percent, which can save time when you have a large file of digitized sound to transmit. There's some distortion of the voice pattern when you play back your message after compression, but it's not enough to deter you from using the mode.

The Chat mode of the LANtastic operating system lets you conduct a real-time two-way telephone discussion across the

EDITOR'S CHOICE

- **An Apple, an Orange, a Peach**

Voice e-mail is a technology still in its infancy. We've come up with a few ways it can show its worth today; undoubtedly, you'll come up with more as the technology evolves. The three products we've reviewed share common technologies and capabilities in their implementation of voice e-mail; but because their developers chose different approaches and targeted buyers with very different goals, we did not select an editor's choice.

If training budgets and computerphobia are ongoing concerns and your company can part with the nearly $9,000 it would take to install Wang's Freestyle System on, for example, an existing three-PC network (with tablets, speaker phones, and a scanner), the product provides off-the-shelf integrated voice, text, and video capabilities available from no other hardware/software combination. It's not difficult to tell that Freestyle requires a total commitment from an organization.

VoxMail is a welcome adjunct to MHS-compatible electronic mail systems like *cc:Mail*, and it is attractive for any users who wish to hear their e-mail from remote sites. It's also the first product we've encountered that interfaces synthesized voice to LAN e-mail, producing voice sounds from ASCII text strings. VoxMail offers freedom and a new way of doing things, but for a hefty price: $4,995 for up to 20 users.

LANtastic's voice e-mail system allows network users to send and receive voice mail for a relatively low price ($495 list for the network operating system and $149 for each voice adapter). It also doesn't require a network; you could use the voice adapter to transmit files of digitized voice via modem.

While the product is beneficial to many users, the greatest benefits may be to those who want to integrate voice into their spreadsheet, word processing, scheduling, and workgroup productivity products. LANtastic's strong API makes it a natural choice for developers wishing to add another dimension to their communications.

FACT FILE

LANtastic
Artisoft Inc., 575 East River Rd., Tucson, AZ 85704; (602) 293-6363.
List Price: Voice adapter, $149; Voice Programmer's Interface, $195.
Requires: 256K RAM, LANtastic network operating system; NetBIOS-compatible LAN adapters (if used on a network), DOS 3.1 or later.
In Short: Artisoft's voice-mail program, built into LANtastic's network operating system software and combined with the vendor's voice adapter card, makes it easy to create and replay voice messages—a network is not required. A Voice Programmer's Interface is available for adding voice to software applications.

CIRCLE 404 ON READER SERVICE CARD

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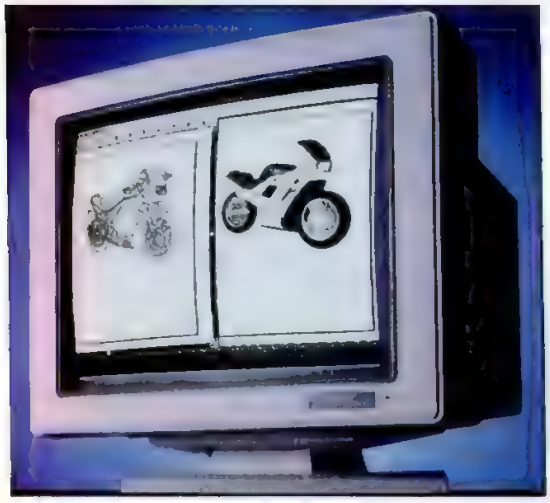
- ☐ 16 Mhz/32 Bit
- ☐ PopStart Cartridge Tape System
- ☐ 1.44 MB 3-1/2" Floppy Drive
- ☐ 101-Key Professional Keyboard with 12 Function Keys
- ☐ 400 dpi Microsoft Mouse
- ☐ 4 MB of SIMM RAM
- ☐ 105 MB Hard Drive
- ☐ TurboView 1280GS™ 19" Dual-Page Outline Font Monitor with gray scaling capabilities
- ☐ TurboSetter 1000 Plus™ Plain-Paper Typesetter
- ☐ Pre-installed software which includes: MS-DOS Version 4.01, Windows, Picture Publisher, Aldus PageMaker (Ventura Publisher available), CorelDRAW!, Microsoft Word for Windows (WordPerfect 5.0 available)
- ☐ NTV Mouse Menu Program
- ☐ NTV 135 Scalable Outline Fonts
- ☐ NTV PopStart™ Cassette with complete system software
- ☐ Free Technical Support
- ☐ One year INTEL Service Plan

TurboSetter 1000 Plus

- ☐ 1000 x 1000 TurboRes Output
- ☐ 135 Professional Quality Scalable Outline Fonts
- ☐ Five to ten times faster than traditional laser printers
- ☐ 6 MB RAM Controller
- ☐ Installation, set-up and driver software utilities included
- ☐ High speed interface cable
- ☐ PostScript EPS file conversion print utility
- ☐ Power cord
- ☐ 1 Ream of high quality paper
- ☐ 1 High Resolution toner cartridge



TurboView 1280GS

- ☐ 19" Dual-Page Outline Font Monitor with gray scaling capabilities
- ☐ 1280 x 1024 screen resolution
- ☐ 1 MB video RAM
- ☐ PC compatible controller
- ☐ Uses the same fonts as the TurboSetter 1000 Plus and scales them on the fly

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Traditional PC LAN

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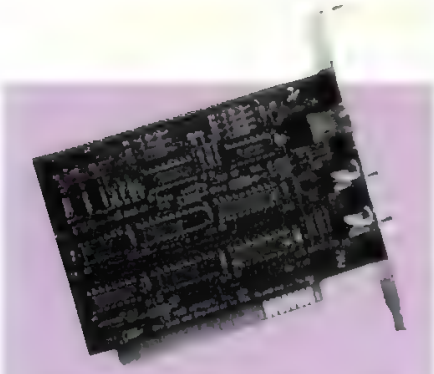


LANtastic's voice mail functions are included as part of Artisoft's network operating system (not shown). The $149 voice adapter card above completes the package, which can be used standalone or as part of a network.

network using the voice adapter boards. However, there is a significant delay due to the transmission process. Most people will find the real office telephone system more responsive, although the Chat mode has some potential in training situations.

Menus ease operation, and on-line help screens assist if you have problems. (Artisoft also has a BBS with marketing and technical information.) You can choose between the Mail Services option or the Chat mode. Under the Mail Services option, you can send a voice message or save an entry to a specified disk file. Choose from a list of recipients and send multiaddress messages. Also, a pop-up e-mail notification alerts a workstation of incoming e-mail. You get separate notifications for digitized sound and standard data messages.

The voice recording and playback screen in the LANtastic e-mail system deserves a special mention. This screen includes a pointer—like the mechanical pointer on a dictating machine—that shows your location in the recorded message and offers excellent rewind, reply, and editing capabilities.

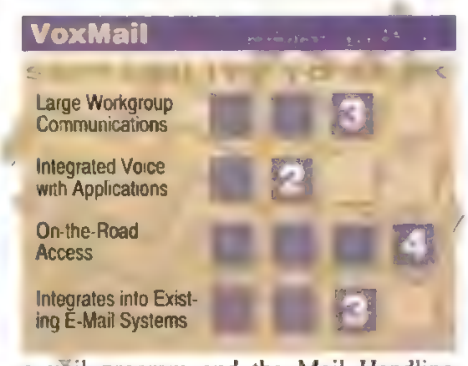
This voice communications feature within Artisoft's LANtastic makes the product a unique entry in the LAN market. The ability to send voice inexpensively over LAN cabling may sound futuristic, but it's available today.

VoxMail

The unique attraction of VoxMail is its ability to "read" your electronic mail to you out loud, even if the e-mail wasn't created using voice. VoxMail also lets you reply to your e-mail correspondents, including those with no voice e-mail capabilities, even when you are miles away from the nearest PC.

VoxLink's $4,995 (priced for up to 20 users) product differs from the two others we reviewed because it isn't a full electronic mail system with voice. Instead, it becomes the voice component of many popular electronic mail systems (among its more traditional telephone voice mail functions).

VoxLink has targeted VoxMail at traveling executives and people without PCs to link them to their e-mail systems over the telephone by converting text to speech. The VoxMail system consists of a speech synthesis card with a telephone interface and menuing software. The system includes support for the popular *cc:Mail* e-mail program and the Mail Handling Service interface to other e-mail packages.



VoxMail's installation process consists of creating a new subdirectory, copying the files there, and adding a line to your AUTOEXEC.BAT file with the name of the directory you've created. Although this task isn't difficult, we would like to see VoxLink add a utility to automate the process.

SYNTHESIZED VOICE

As far as we know, VoxMail is the first product to interface synthesized voice to LAN e-mail. Synthesized voice systems produce voice sounds from chips (often with a distinct Swedish-sounding accent) in response to receiving an ASCII text string. This contrasts to digital voice systems like Freestyle and LANtastic that record actual voices using digital techniques.

The version of VoxMail we reviewed did not include a digital voice system for creating voice e-mail; this feature is expected in an upcoming release.

Since VoxMail operates as a dedicated server on the network, you need only one system per server. Users who simply want to see their e-mail on the screen use the standard network e-mail system. But if you want to *hear* your mail, you access the VoxMail server from a phone, in or out of the office. Once you attach the phone line to the card provided, you are ready to set up your mailboxes and passwords.

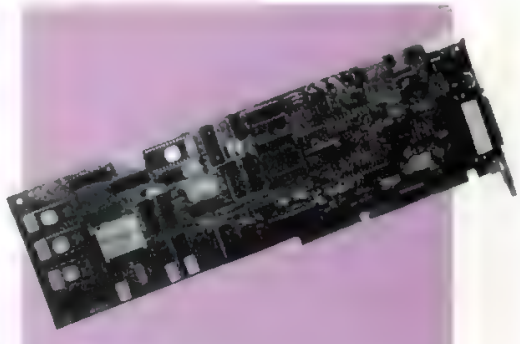
A program called VMUSER lets network administrators set the system password and user password lengths. VMUSER also gives access to system maintenance functions and permits editing of default settings.

Users listen to their e-mail by pushing buttons on a Touch-tone phone. VoxMail scans the mail message, reads the text, and notifies you if there is an unreadable attachment such as a spreadsheet. Of course, hearing the message is only half the job; you need some way to reply. VoxMail lets you respond to your messages—in writing—with canned replies like, "I agree," "No, wait until we talk," or other custom responses the system administrator assigns to the phone buttons. This gives you excellent flexibility to configure the system to your exact requirements.

VoxMail logs all transactions to a disk file, including failed access attempts. The VMLOG program prints the information in the log file based on selected criteria. Flexible query options allow the system manager to see only the important information.

AUDIT TRAILING

VoxMail helps you keep an audit trail of conversations. If your subject heading is too long for the subject field or you intro-



VoxLink's VoxMail system, $4,995 for up to 20 users, consists of a speech synthesis card with a telephone interface and menuing software (not shown). It runs *cc:Mail* and other e-mail packages that support the Mail Handling Service interface.

The VoxMail management screen allows you to manage the authorized users and the canned messages used for replies generated via Touch-tone telephones.

duce another topic during a reply to a previous message, VoxMail adds another subject field to the body of the message. Experienced e-mail users understand how this useful feature allows better management of your mail.

While the VoxMail version reviewed here supports only synthesized speech, an upgrade that began to ship as we went to press combines new hardware with enhanced software to ease mail management. The VoxMail upgrade adds voice e-mail with digitized voice. It combines your messages into one mailbox, not multiple mailboxes, for each type of media.

In addition to interchangeable and digitized prompts, the upgraded version includes a complete telephone voice-mail system and a fax-forwarding feature. Check your e-mail inbox and you will see voice mail messages listed as entries.

Another useful feature will be VoxFax, which lets you send your nonvoice e-mail to a fax machine. In conjunction with a third-party fax gateway (see "LAN Fax Gateways: Can They Eliminate Fax Machine Bottlenecks?" *PC Magazine*, April 10, 1990), VoxFax faxes selected pieces of your mail to a fax machine near you. While you check your mail from a phone,

FACT FILE

VoxMail
VoxLink Corp., P.O. Box 23306, Nashville, TN 37202; (615) 331-0275.
List Price: Speech synthesis cards and software for up to 20 users, $4,995; for unlimited users, $8,995.
Requires: 512K RAM; *cc:Mail*, Version 3.03 or later, or other e-mail system accessible via MHS; DOS 3.1 or later.
In Short: Though prohibitively expensive, VoxLink is a slick way to check your e-mail from a telephone without a computer and modem. It also provides a solid foundation for future enhancements.

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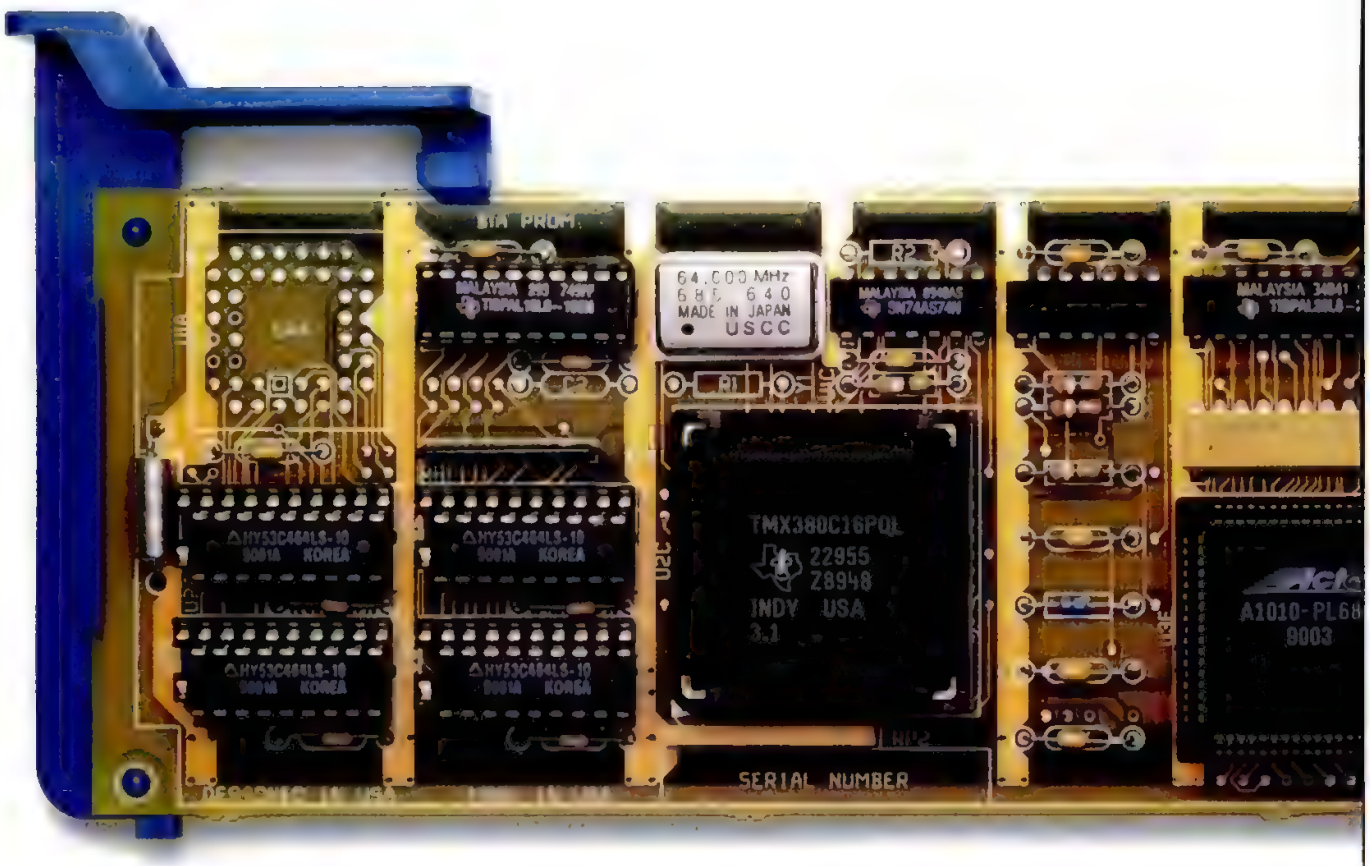

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When we developed the IRMA™ board nearly a decade ago, no one could have anticipated all the needs and options for connectivity that have emerged since.

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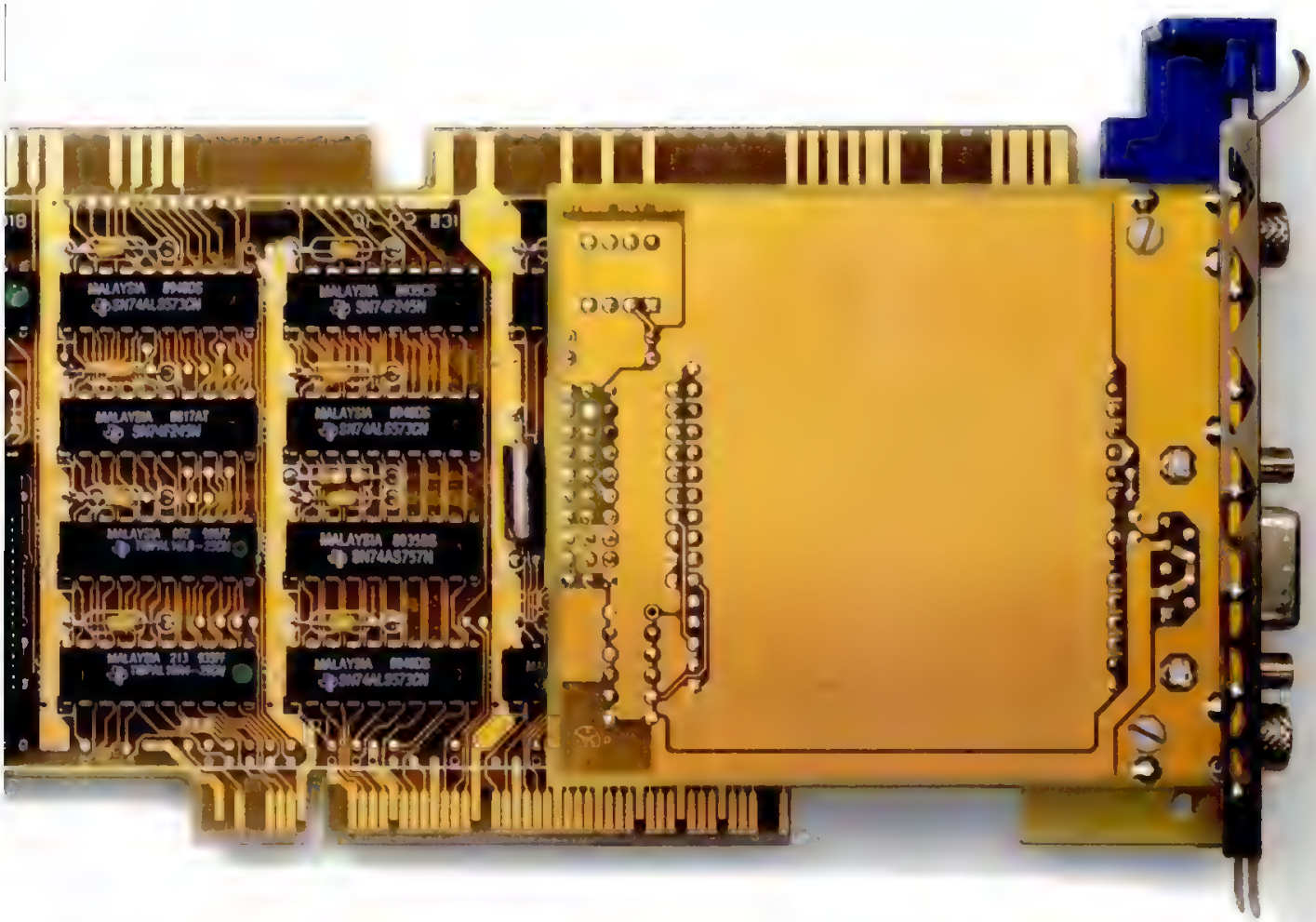

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All in all, IRMAtrac Token-Ring is one exciting connectivity solution. Actually, it's many connectivity solutions. And in today's environment, that's where the excitement truly lies.

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DCA

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you simply enter the phone number of the closest fax, and your mail shows up there. Of course, this only works with file formats that are compatible with the fax gateway software.

VoxMail is an excellent product in search of a great marketing company. The initial product offering was a step in the right direction. With its new release, VoxLink is off and running.

Wang Freestyle System

Computerphobia is one of the biggest production problems facing business today, and Wang targets Freestyle toward large organizations that want to keep training costs low and productivity high.

Designed to let you work "with" a computer the way you do without one, Freestyle runs on the Wang PC 200/300 Series and AT compatibles and combines voice input, an electronic tablet with a special pen, great graphics, and software into one package aimed at helping people use a computer without modifying their work habits. Freestyle and LAN Office go far beyond voice e-mail functions, but for this review we're concentrating only on those capabilities.

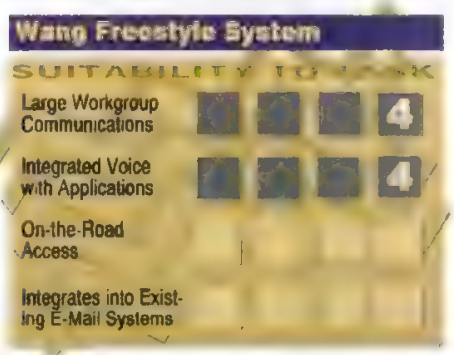
Freestyle interacts with existing applications and allows you to capture screens, annotate them with *handwritten* text and speech, and then send them off through various electronic mail systems. During demos, the Wang representatives used the Freestyle software (called *Freestyle Light*) to grab a spreadsheet from the screen, circle and draw arrows to various numbers in the spreadsheet using the electronic pen and tablet, and dictate a verbal description of what the numbers meant. A touch of the pencil on an icon sent the spreadsheet, with spoken and handwritten annotations, to a recipient chosen from a mailing list.

Our tested configuration of Wang's Freestyle System included *Freestyle Light* software (not shown), an electronic tablet and pen, and a telephone handset. Wang's LAN Office software and 16-bit boards are needed.

When the recipient gets the e-mail message, Freestyle plays it back at the same rate it was recorded. The recipient doesn't just get a single graphic on the screen; instead, the presentation unfolds in the same logical sequence.

PRICING THE SYSTEM

Freestyle's price depends on what you need. We equipped two PCs with the Freestyle software and hardware, including two tablets, two voice interfaces with speaker phones, two LAN Office nodes, LAN Office, and a scanner. The list price for this configuration is well over $6,000—in addition to the PCs needed to run everything. Wang prices the Freestyle components for each additional workstation at $1,890 without the $1,600 scanner.



Another cost factor is that LAN Office requires a server dedicated to distributing mail to workstations. The mail server queues mail from all the nodes and distributes the mail to local users or, through a gateway, to remote users.

The original Freestyle system ran only on Wang hardware and the company's own network; the current version supports several third-party products: Banyan's *VINES*, Novell's *NetWare*, 3Com's *3+Share* and *3+Open*, and IBM's *PC LAN*. Support for other third-party products remains distant.

INSTALLING FREESTYLE

Even though Wang supplies good documentation, installation and setup aren't simple. Each piece of hardware requires a 16-bit AT-compatible expansion bus slot. Users with crowded ATs must take care to allocate interrupts and I/O address locations when installing all three cards.

We recommend checking your AUTOEXEC.BAT file after the supplied FINSTALL program completes the installation process to make sure everything is in the right place. It took a considerable amount of help from the Wang technical support staff to get everything working, but things became easier once installation was over.

Since Freestyle uses multidimensional data (text, graphics, and voice), storing numerous documents requires many megabytes of disk space. Freestyle stores all the information associated with a document in separate files.

The graphics and voice files occupy the most disk space—for the latter, it's 4K per second with silence compression. In other words, a 5-minute message, with a total of 20 seconds of silence between words, takes up 1MB of disk space. Wang assumes you'll use the system to handle all your daily tasks. If you do, you'd better own a hard disk farm.

REPRESENTATION OF DESK

The Freestyle System's screen is a representation of your desk, with an icon for certain functions you might use every day. These include a filing cabinet, folders, mailbox, fax machine, printer, scanner, and trash can. You create documents using these tools, just as you would without a computer.

When you touch the special electronic pencil to the tablet, Freestyle quickly

FACT FILE

Wang Freestyle System
Wang Laboratories Inc., One Industrial Ave., Lowell, MA 01851; (800) 522-WANG, (508) 459-5000.
List Price: LAN Office, $795 per server; Freestyle Light, $249; tablet, $995; scanner with software, $1,600; voice option with speaker phone, $795, LAN Office node license, $100.
Requires: 640K RAM; AT-class computer or better, Banyan *VINES*, Novell *NetWare*, 3Com's *3+Share* or *3+Open*, or IBM *PC LAN*; LAN Office, *Freestyle Light*, LAN Office workstation license, and Freestyle Voice option; DOS 3.2 or later.
In Short: An innovative office information management and communications tool. More of an entire office automation system than a voice e-mail system, Freestyle smoothly implements LAN voice e-mail. Intended primarily for large organizations with many computer novices.

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—*PC Magazine, May 29, 1990*

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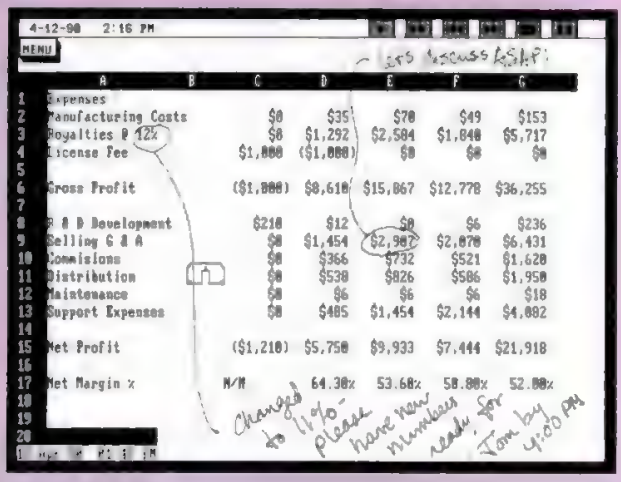


Using the electronic tablet included with Wang's Freestyle System, users can add a signature or notes to a displayed page. The symbols across the top—familiar to any VCR owner—let you control speech functions like playback and rewind.

swaps all of your running programs to disk and loads itself. Since Freestyle stores so much away, you have to set up network drivers so the program can't unload them; otherwise it won't find the network resources it requires. Surprisingly, despite its complicated nature, Freestyle works with most popular applications, including *Microsoft Windows* 2.1.

Freestyle takes a picture of the screen when you touch the pencil to the tablet; this image is the basis for all communication. Graphic buttons, resembling those on your VCR, appear on the top line of the screen to control the speech functions. You start recording as you use the pencil or keyboard to enter information.

To send the finished file, you drag it to the mailbox and select one or more recipients. When the addressees get their mail, Freestyle plays the sound back through the speaker phone and shows notations on the screen at the same rate at which you created them.

The technical quality of Freestyle is excellent. Voices sound completely natural and better than local telephone quality. The visual presentations are easy to use. And those of you prone to mousing will be happy that Wang has recently included mouse drivers in the software. Using a mouse instead of the tablet can considerably reduce the system's cost, although it won't do much for your on-screen penmanship.

The Freestyle phone and address book contains the transport information for each person with whom you communicate. Some have fax machines, others are connected to the LAN, and still others are connected through a gateway. As you send documents, the Mail system knows about each person's address and sends the documents accordingly.

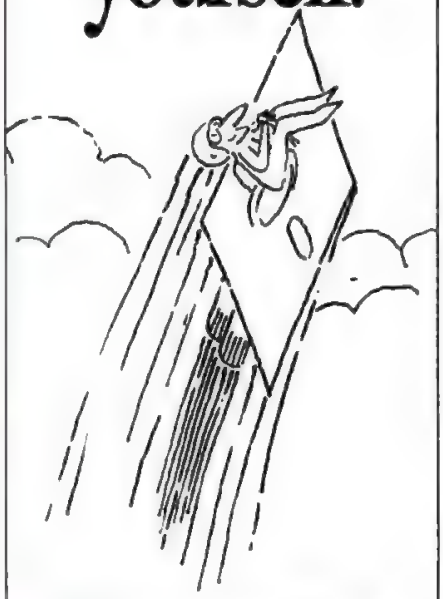
Freestyle is a great product built on a fascinating concept. The voice e-mail is extremely useful and a cinch to operate, although the product needs more support for third-party scanners, fax cards, and digitizers.

> Wang's Freestyle System takes a picture of the screen when you touch the pencil to the tablet; this image is the basis for all communication.

Initial price and hard disk consumption put this system beyond the reach of people with limited budgets. But if your accountants value productivity and creativity, you can justify the costs. ■

Frank J. Derfler, Jr. *is workgroup systems editor of* PC Magazine. **Kimberly Maxwell** *is a newspaper reporter who now makes computers her beat.* **M. Keith Thompson** *is the inventor of the AT Turbo Switch and the founder and former CEO of Megahertz Corp.*

Express yourself.



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PC MAGAZINE EDITORS' CHOICE 2-14-89

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PC Magazine 2/14/89

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PC World 2/90

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Tom Swan, "Developer's Toolbox," PC World 9/89

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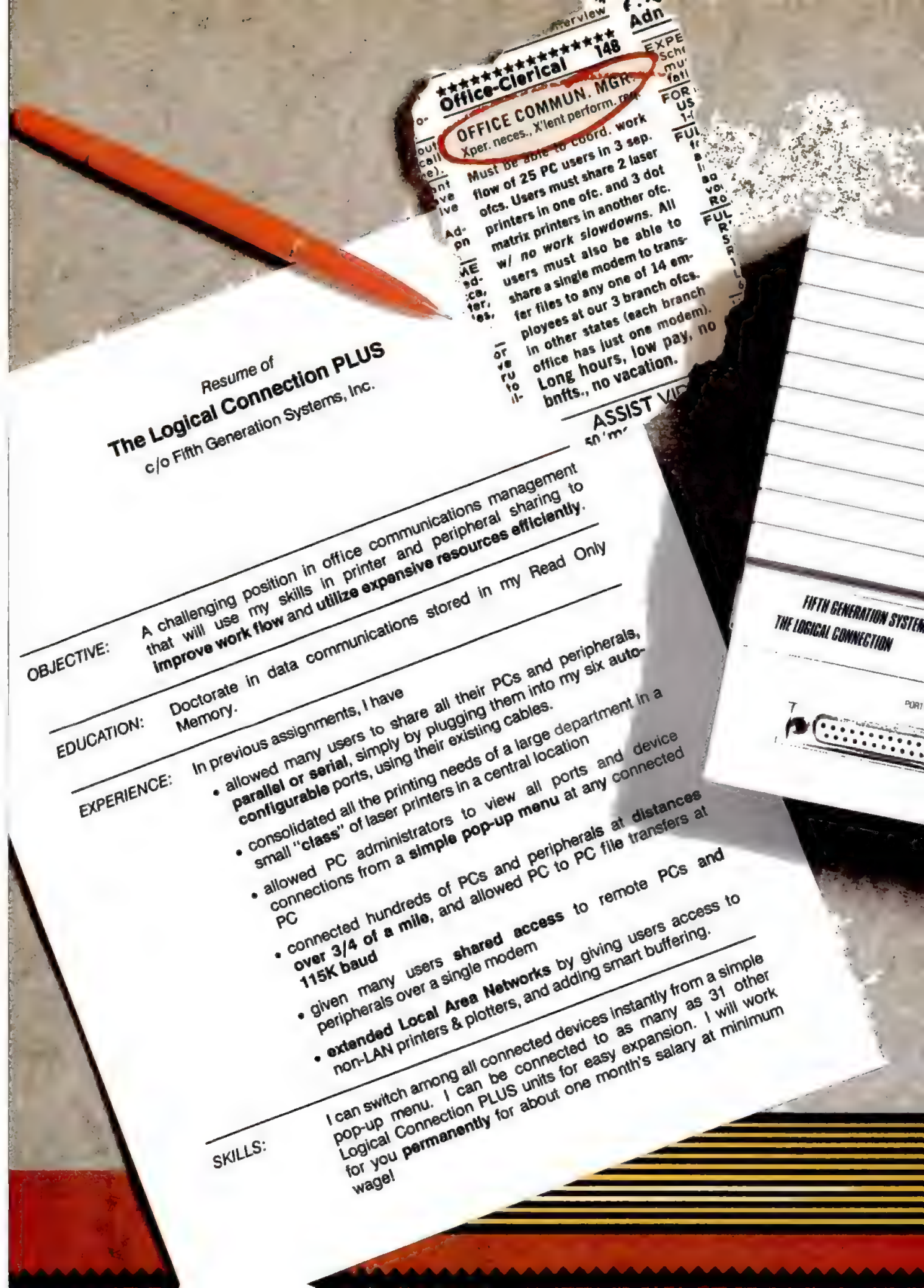
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Xper. neces., X'lent perform. req.
Must be able to coord. work flow of 25 PC users in 3 sep. ofcs. Users must share 2 laser printers in one ofc. and 3 dot matrix printers in another ofc. w/ no work slowdowns. All users must also be able to share a single modem to transfer files to any one of 14 employees at our 3 branch ofcs. in other states (each branch office has just one modem). Long hours, low pay, no bnfts., no vacation.
ASSIST VI
Resume of
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OBJECTIVE: A challenging position in office communications management that will use my skills in printer and peripheral sharing to improve work flow and utilize expensive resources efficiently.
EDUCATION: Doctorate in data communications stored in my Read Only Memory.
EXPERIENCE: In previous assignments, I have
• allowed many users to share all their PCs and peripherals, parallel or serial, simply by plugging them into my six auto-configurable ports, using their existing cables.
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SKILLS: I can switch among all connected devices instantly from a simple pop-up menu. I can be connected to as many as 31 other Logical Connection PLUS units for easy expansion. I will work for you permanently for about one month's salary at minimum wage!
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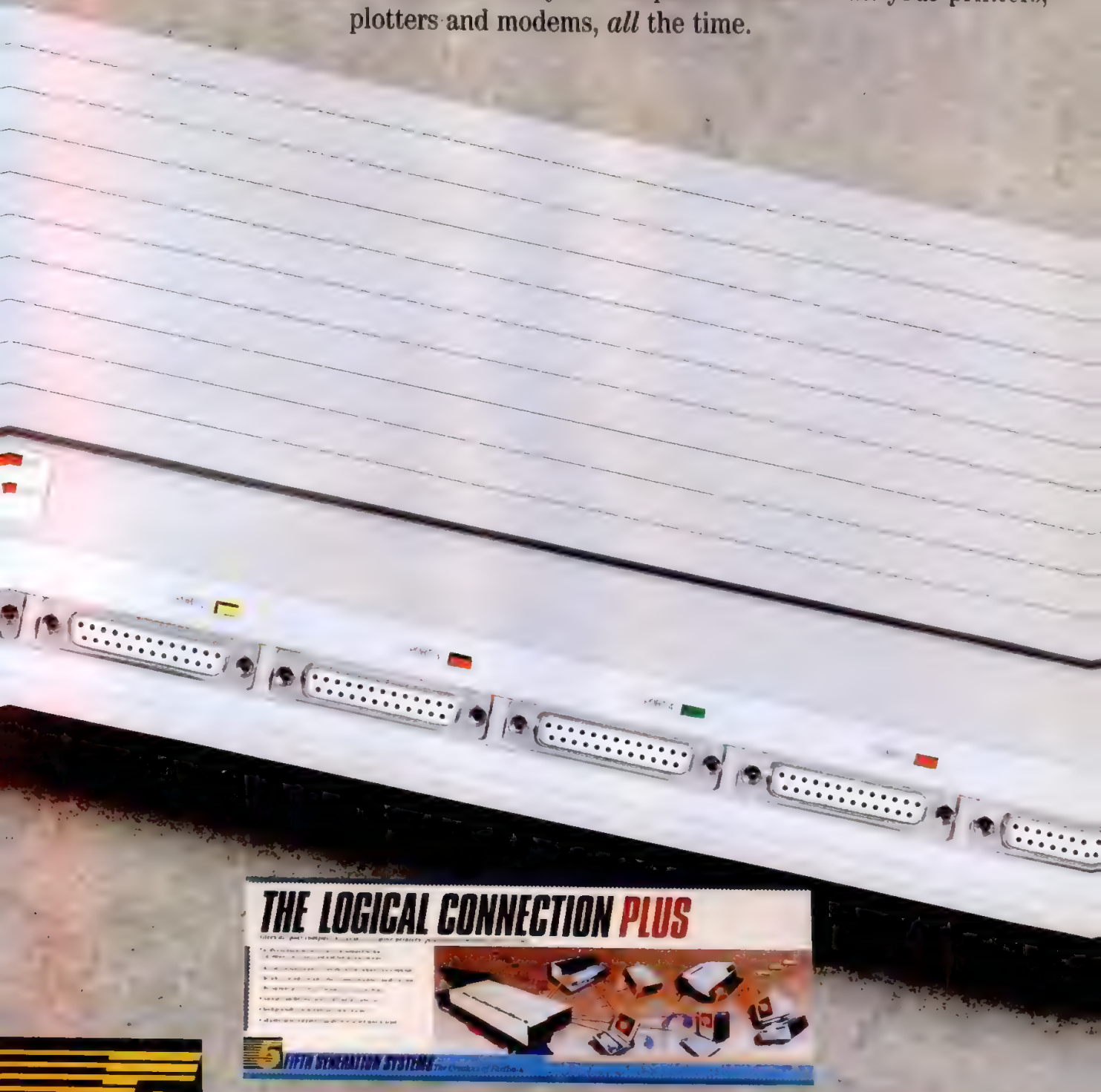

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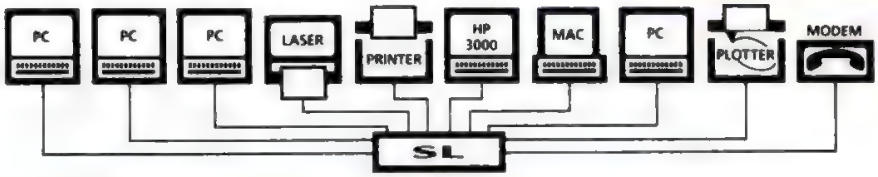

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by
Tami Peterson

Lab Notes

Presentation Manager: The Future of Desktop Publishing Is Here

Desktop publishing applications for the PC could never have been developed without a graphical user interface (GUI) such as *Windows* or *GEM*. Today, however, the OS/2 Presentation Manager offers even greater power and functionality, and publishing applications are casting aside the DOS GUIs that made them possible and are migrating to the new platform. Ironically, these very publishing applications are themselves now foundation blocks upon which the success of OS/2 and Presentation Manager is being built.

The irony intensifies when you consider where desktop publishing earned its wings. That was of course, on the Macintosh, a machine derided for years by "blue-blooded" PC users for using exactly the kind of software that inspired desktop publishing. These once low-caste Mac applications are now playing a critical role in the future of the operating system that will humble once-proud DOS.

Amusing as these turnabouts may be, the strategic minds at Microsoft see more in them than entertainment value. Alive to the importance of desktop publishing, in 1989 Microsoft created the first (and only) vertical niche within its PM development area, a niche devoted exclusively to nurturing and evangelizing desktop publishing in the Presentation Manager environment. Headed by Linda Archer, this special unit provides publishing-related PM developers with unstinting support in answering and channeling technical and promotional questions. The very existence of such a group is also a reply to critics who have questioned Microsoft's commitment to OS/2 and PM. So now the only question remaining is whether you're ready to commit to OS/2 and PM.

To help you decide, the sidebar "Desktop Publishing Hardware," will give you an idea of what—at current New York street prices—desktop publishing in the new environment will cost. A minimally configured system built to run a PM desktop publishing application can be had for as little as $7,500. This would include a 25-MHz 386 clone, 4MB of RAM, a 40MB hard disk drive, an inexpensive color VGA monitor and card, a mouse, OS/2, *PageMaker*, a word processor, and an economy-class PostScript-compatible printer and cables.

> ■ New PM releases of PageMaker and other DTP products should be all the impetus you need to start planning for OS/2 today.

If you're not technically proficient with hardware and software, however, you'd probably better stay with quality name brands. In this case, plan on doubling the no-frills price. One component not to economize on is memory. Although it is *possible* to run OS/2 with less than 4MB of RAM, no one—including Microsoft—recommends that you try. Indeed, OS/2 2.0 is expected to force up the recommended RAM to 6MB. However, it will also begin to allow real-mode applications to interact with those running in protected-mode; *Windows*, previously restricted to the limited DOS compatibility box of OS/2 1.2, is expected to get its first real view of PM; and Version 2.0 promises to be far more hospitable to other important system resources.

Most of us have seen not only the time and cost benefits, but also the added creativity that investments in desktop publish-

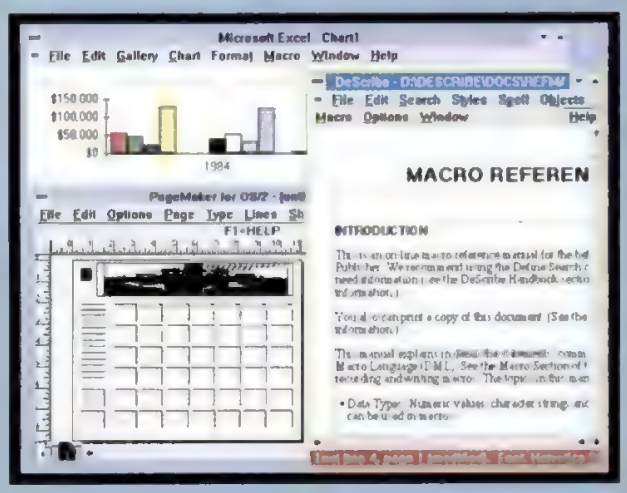

Figure 1: These three major OS/2 applications—*PageMaker, Excel,* and *DeScribe*—are running simultaneously under the Presentation Manager.

ing have made possible in the past. The question facing desktop publishers now is whether OS/2 and Presentation Manager will provide sufficient additional benefits to justify additional expenditures.

PAGEMAKER PM

For some *PageMaker* users, the increased speed of the new *PageMaker for the Presentation Manager* (hereafter *PageMaker PM*) is reason enough to make the switch from the *Windows* version. Corporate users I've asked tend to justify the purchase of *PageMaker* in the OS/2 PM environment even when it means upgrading to something like an IBM PS/2 model 70 with 4MB of RAM.

PageMaker PM's overall performance improvement is not limited to the virtues conferred by being able to use abundant memory. The product also incorporates some impressive multitasking capabilities that speed throughput and that are only possible under OS/2. (Even *Windows* 3.0 will not be able to provide the true multitasking facilities needed for background operations.) Text autoflow, for example, is a *PageMaker* function that, under PM, can operate transparently in the background. This means that while text is flowing you can go on working, either in the same publication, in another simultaneously open publication (a new feature of *PageMaker PM*), or even in another application outside *PageMaker* altogether. The same background functionality can also be employed when printing or reformatting.

There are other minor but useful enhancements in *PageMaker PM*, such as an intelligent ASCII import facility with several options that go beyond merely stripping off line-ending returns. For instance, a Lotus .PRN file can now be imported with the spaces between its columns automatically replaced by tabs. (Regrettably, however, *PageMaker* still does not provide the option of displaying tabs, returns and other nonprinting characters on the screen.)

One disappointment I experienced while using *PageMaker PM* was an inability to use the clipboard to import *Microsoft Excel* charts in metafile format. The reason points to the kind of difficulty to be expected in a rapidly developing field. *PageMaker PM* was one of the first PM products to ship, so Aldus had to write it to OS/2 1.1 specifications. Between OS/2 1.1 and OS/2 1.2, however, the metafile format (among other things) was changed. *Excel PM*, written directly for OS/2 1.2, conforms to the newer, different metafile format.

Thus, *PageMaker PM* can't read *Excel*'s metafiles until its own program is upgraded. In the meantime, however, you can copy an *Excel* PM chart as a bitmap file (use Shift, Edit, Copy Picture). The bitmap so generated will require a fair amount of available system memory or enough available disk space for caching. In general, Aldus recommends you keep at least 5MB of disk space free for all *PageMaker* caching requirements. (If your drive is partitioned and has larger amounts of free memory on a drive other than C:, you'll want to amend the SWAPPATH statement in the CONFIG.SYS file to use it for caching. Aldus also recommends increasing the OS/2 SWAPPATH default of 512K to 2.5MB.)

The lack of adequate and functional printer drivers in that early version of OS/2 is another example of the limitations Aldus faced. The early beta and first-release customers have simply adjusted to other output alternatives, such as printing publications to disk en route to printers, judging this to be a fair trade-off for the increased speed and background functionality of *PageMaker PM*. Fortunately, OS/2 1.2 offers much better printer support and requires little or no vendor intervention to upgrade this area.

DDE AND OTHER FEATURES

Not all OS/2 and PM enhancements are so easy for developers to handle, however. One of PM's most valued features, Dynamic Data Exchange, for example, will remain absent from many first-generation PM products—including *PageMaker* and *Ventura Publisher*. (The latter is about to go into beta testing at the time of this writing.) Dynamic Data Exchange (DDE) involves the ability to create live ("hot") links of text or image data among different applications. PM provides the tools for this functionality, but the programming to implement it is complex. For this reason, many independent software vendors (ISVs), will delay its inclusion until OS/2 itself becomes a more stable platform.

To date, as Ray Duncan has repeatedly commented in his Power Programming column, each new update of OS/2 has required a major overhaul of an existing OS/2 product. This produces much frustration and little immediate payback. Hence, even though OS/2 1.2 is a more stable environment, provides better printer capabilities, and supports the High Performance File System (HPFS), you won't begin to see wide implementation of these features (or DDE) until sometime after the release of OS/2 2.0. (Since Version 2.0 is now in prerelease, ISVs can bypass Version 1.2 altogether if they choose.)

In this connection, it should be noted that vendors who have and intend to produce multiplatform versions of their products face difficulties and limitations that single-line PM developers do not. While multiplatform ISVs are obviously committed to OS/2, most of them have an existing *Windows* product and DOS customers to consider. These customers are paying the freight, and their need is more for cross-version compatibility than for the latest

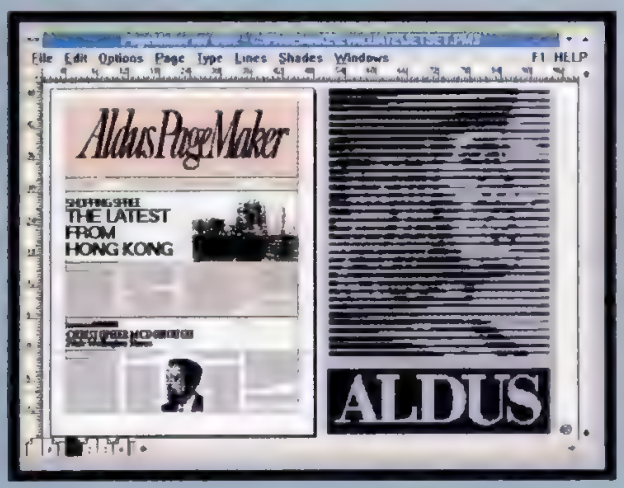

Figure 2: *PageMaker PM* has some impressive multitasking functions that let you print, format, or flow text in the background while working in a separate application.

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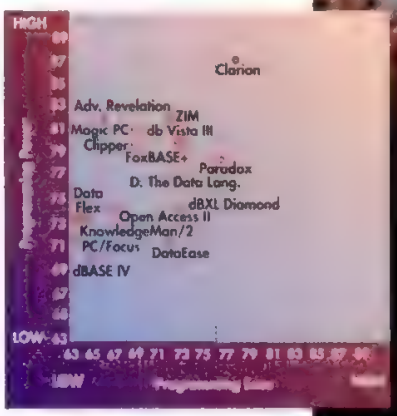

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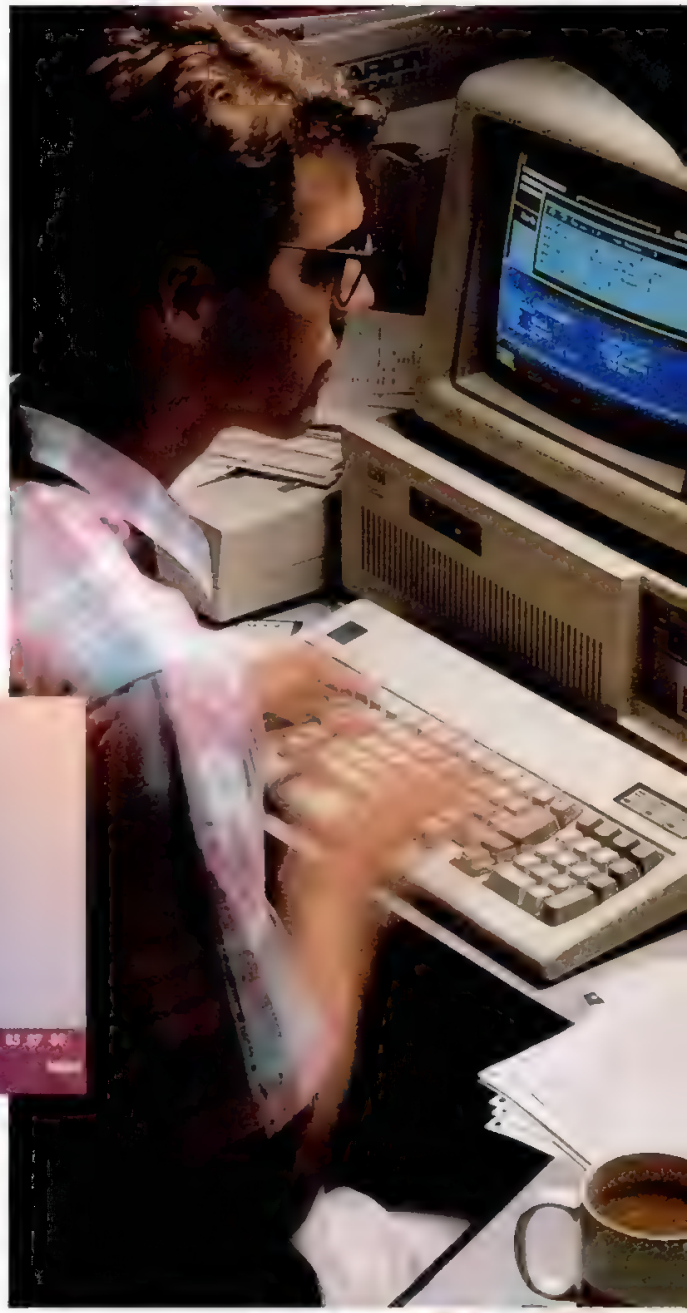

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OS/2 technology.

DDE will again serve to illustrate the problem. While both *Windows* and PM offer DDE, OS/2 offers sophisticated multithreaded, nonpreemptive tasking, giving it far greater DDE capabilities than those available under *Windows*. *Windows* offers quasimultitasking, but it lacks the nonpreemptive functionality of OS/2. What, then, should a vendor do when he tries to write for multiple platforms? He can only maintain consistency between environments by bringing out a product whose features represent a lowest common denominator, and even this requires writing vastly different sets of code for the two environments. Consequently, you can expect to see only minor feature enhancements within first generation PM products that have a *Windows* counterpart.

To multiplatform ISVs and their corporate customers, then, cross-version compatibility is important enough to warrant whatever programming lags result. Part of Aldus's success with *PageMaker PM* stems from the kind of workaround users have been able to employ to solve the infamous OS/2 print-driver problem. One solution has been to prepare publications in *PageMaker PM* and then to move them back to *PageMaker* under *Windows*, where printer driver support is abundant. Typically, this is not a once-only proposition: files must often be shipped back and forth between the two platforms repeatedly, and absolute data integrity must be assured. While Aldus mentions, in a release note, that font width tables between environments do not always match and can affect line breaks, users with whom I have spoken have been lavish in their praise of the file fidelity maintained when crossing platforms.

DESCRIBE

One new publishing application on the market may compel more than a few users to consider an immediate move to PM. Unhampered by a DOS product/customer base to support, DeScribe, a Sacramento, California–based developer, was out early with its PM product, *DeScribe*—an impressive first release. The company's next upgrade is expected to be compatible with OS/2 1.2 and offer the most advanced DDE capabilities of any PM product in the publishing realm to date.

DeScribe is not exactly a word processor, nor is it a desktop publisher. It might more accurately be termed a "word publisher." The product is similar in design and functionality to Microsoft's *Word for Windows*. The page-layout and high-end-publishing capabilities fall short of the best desktop publishers, so you wouldn't use this product for designing and producing brochures, posters, magazines, or books. What you would consider using it for is daily word processing that requires report-quality output and regularly incorporates tables, charts, and pictures from other PM applications.

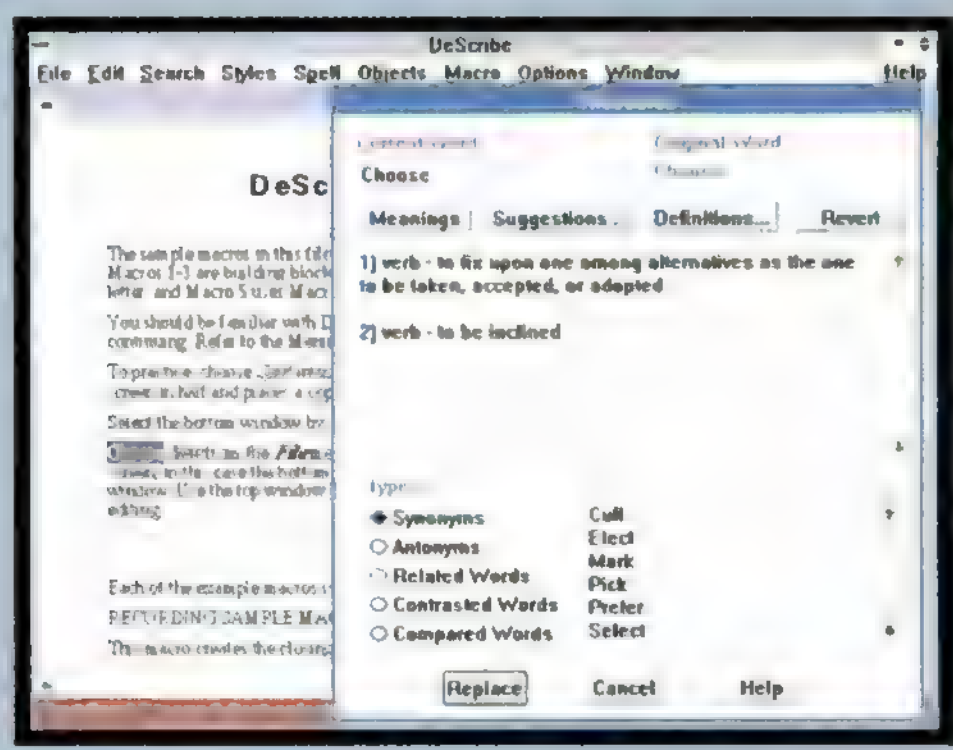

Figure 3: Among *DeScribe*'s excellent word processing features is an interactive thesaurus, which can distinguish between synonyms and related words.

Although not specifically a desktop publisher, *DeScribe* offers the best integrated publishing currently available. Using special DDE paste-links, *DeScribe* lets you work in concert with all other PM applications. *Excel PM* users will be particularly delighted, for since *Excel* charts are already dynamically linked to their spreadsheet sources, you really gain a three-level link when you bring them into *DeScribe*.

Accuracy and consistency are perhaps the two biggest advantages to using DDE—especially when changes are being made under tight deadlines. Linked charts can be resized within *DeScribe*, and if the chart type is changed within *Excel*'s Gallery, the update will occur simultaneously in *DeScribe*. The same paste-link functionality also works with *Excel* spreadsheets for displaying "live" tabular data in a *DeScribe* document. And the tape-recorder-style macro facility within *DeScribe* lets you play back these and other functions in future documents.

Even if DDE is not your main concern, you might want to convert to *DeScribe* for its word publishing and processing features alone. If you write professionally, *DeScribe*'s spell-checker, interactive thesaurus, and dictionary are enticing. For starters, you can opt to spell a word, a selection of text, the contents of an object (that is, placeholder or frame), or the entire document. Through each of these venues, you're taken into the word maven's equivalent of the child's candy store. For each suggested spelling, you can elect to view a full dictionary with noun and verb usages and syllabic divisions and associated inflections for the current word.

If you're unsatisfied with the word at hand, *DeScribe*'s thesaurus will help you pick a more appropriate one. Unlike the common on-line thesaurus, this one doesn't lump synonyms into only two categories—nouns and verbs; instead, *DeScribe* distinguishes between true synonyms and merely related words. It also gives you the luxury of seeing antonyms, contrasted, and compared words. Choose any of these options and explore! The hierarchy just goes on and on, every move performed intuitively and without effort. In fact, if you are familiar with *Windows* and a few of its better applications, you'll find that it's not necessary to read *DeScribe*'s handsome, if somewhat sketchy, documentation.

All in all, the *DeScribe* developers have a handle on the features that concern writers and many "self-publishers"—features that find their most natural implementation within the PM environment.

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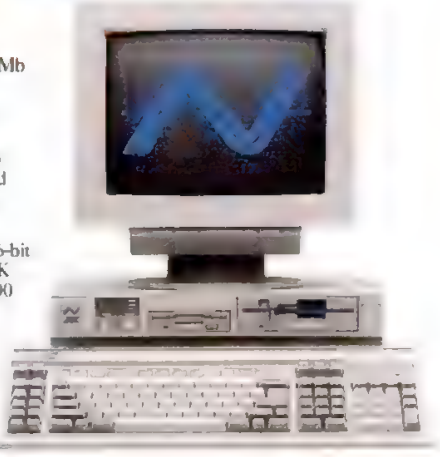

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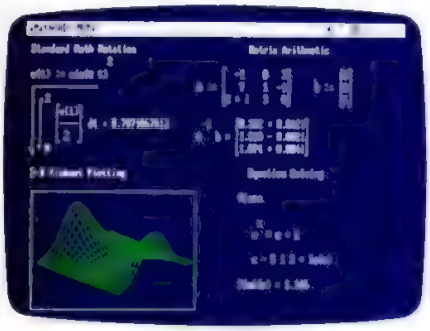

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leased by the time you read this article. Several illustration and drawing programs will also be available, including *Micrografx Designer*, Corel Systems' *Corel Draw!*, and Computer Support's *Arts & Letters*.

Another major PM publishing product you can expect to see sometime in the second quarter of 1990 is *Ventura Publisher*. Xerox Desktop Software, the division of Xerox that manages the marketing and development of *Ventura*, also plans to release a *Windows* 3.0 version at about the same time.

Xerox Desktop Software faces a unique challenge in its PM development. While most PM applications grew up in and outgrew *Windows*, *Ventura* originated from *GEM*-based code. A thorough redesign was required for it to take advantage of the PM environment. Moreover, while *PageMaker* users are generally happy with the product per se but unsatisfied with its performance under *Windows*, *Ventura* users are generally happy both with the product and with its performance in *GEM*. It's unknown at this point whether the redesign will put *Ventura* into the same general performance category as *PageMaker PM*. If so, some of the *Ventura* users may very well decide to remain with their original DOS version.

In general, features comparable with those found in the current release of *PageMaker PM* are expected to appear in the premier version of *Ventura PM*. These will include both background processing and multiple document handling. But until OS/2 can fully support network software and *Ventura PM* incorporates the "big" OS/2 features (for example, DDE), Xerox Desktop Software may have a tough time convincing present users to journey into the Presentation Manager.

TRUE TYPE ENHANCEMENTS TO PM

This preview of desktop publishing under OS/2's Presentation Manager would hardly be complete without mentioning the Apple True Type (formerly called Royal) technology that Microsoft has licensed for use in its products. Just as OS/2 will ultimately provide a common ground for all PC applications, True Type will provide developers with a common basis of device-independence for displaying and printing fonts.

Put simply, from a single True Type outline font, you can generate a raster font of any size for any graphic screen or any printer. Ultimately—and I must emphasize the word ultimately—your printer won't need all the cartridge fonts and software fonts to which you've become accustomed. Both screen and printer fonts will be generated from the same True Type outlines.

You can see a crude form of what True Type technology will bring when you select the *Windows* screen fonts for Modern, Script, Roman, and other typefaces. However, these *Windows* screen fonts are stroke type, unfilled, and contain no scaling hints that spell the difference between good-looking and bad-looking fonts. True Type's renditions are curved outlines capable of solid fills, and they are hinted.

With a True Type outline font, desktop publishers can effect a raster font for any screen or printer.

The resources required to use True Type screen fonts as a means of producing printer fonts is presently much too slow and memory-intensive to be practical. So when True Type is introduced to PM and for some time thereafter, it will still behoove you to own all the printer fonts you plan to use, relying on True Type's expertise to manage the screen.

Eventually, you'll be able to purchase True Type fonts the same way you do Adobe and PCL fonts. If you've spent thousands or even just hundreds of dollars on Adobe typefaces, however, you may be more concerned about whether the new font technology can be used together with the typefaces you already own. Fortunately, this will not present a problem.

For the immediate future, at least, you will inform PM, through the OS/2 print manager, where your typefaces reside. Assuming you have associated them with a currently selected output device, these fonts will then appear, as usual, in the font menus of your applications. What you will see on your screen as you work is an almost perfectly matched True Type font that has been interpreted from the metrics of each Adobe font you use.

As my "almost perfectly matched" hedge implies, unless the printer font is also a True Type font, a 100-percent match cannot be *absolutely* guaranteed. However, at least with the commonly used varieties of Times Roman and Helvetica, the match will almost certainly *appear* to be 100 percent. Indeed, you will probably have a better screen font match than is available within current operating environments. This is because what True Type generates is a mathematically equivalent screen font for *any* point size selected. To get this quality now requires storing individual screen font files with preprocessed (sized) images.

The third-party development opportunities, either conforming to True Type specifications directly or offering parallel conversion routines, are legion. For example, a third-party developer might offer you a conversion program that would generate an entirely separate True Type library based upon your Adobe or Bitstream collection. Another natural offering would be a True Type compatibility cartridge for your HP LaserJet. Such a cartridge would contain the so-called Adobe 13 fonts that are expected, in True Type format, to ship with the premier True Type–enhanced Presentation Manager.

Naturally, when asked when True Type would actually debut, Microsoft declined to answer. But when questioned as to whether developers and users would be subject to the same *dribbleware* distribution of True Type enhancements as they currently are with OS/2, Microsoft's PM font authority, Viktor Grabner, was unequivocal: "You will *not* see a semiusable True Type!"

By the time you read this Lab Notes, Microsoft will presumably have shipped its long-promised HP LaserJet driver with PCL soft font support. This should not be confused with the new True Type technology. But it should help you realize that although True Type will be built into future versions of PM, it will be done in a way that expands rather than restricts your choices. You will still be able to manage your existing fonts in an improved but similar manner to the way you've become accustomed to under *Windows*.

Will *Windows* 3.0 itself eventually support the True Type technology? The answer is a definite yes, and the time frame will likely be less than a year from now.

DESKTOP PUBLISHING HARDWARE

by Tami Peterson

Here are three different workstation configurations equipped for desktop publishing. Each is perfectly suited for the DTP application installed. These workstations offer a comparison of two factors: price and performance. The prices shown are actually advertised street prices (nobody pays list in the real world) that can likely be matched in most metropolitan areas.

In terms of performance, you'll see that one of the DOS workstations is a 286 machine running *Ventura Publisher*. This is presented as a *real* alternative, since *Ventura* is the only high-end desktop publishing application that can reasonably be run on an AT-class machine. The other workstation, an 80/386-based model, will run either *PageMaker*, *Ventura*, or any other DOS DTP application you choose.

The third workstation is, of course, an 80/386-based model running OS/2. Although not an absolute requirement, this computer is equipped with a somewhat larger hard disk drive. (This is to accommodate the many PM applications with large graphics files, together with a significant DOS application subset). A larger hard disk drive, together with the need for additional memory, are the two primary cost boosters on a DTP workstation that is running under OS/2.

With memory prices greatly dropped in 1990 from their high mark in 1988 and with the increasingly low cost of mass storage, you can see that the requirements to run OS/2 are not so imposing.

With any of these model workstations, a laser printer is also a necessity. As good a PostScript printer as can be afforded, regardless of the environment, is the rule. For this reason I've left printers out of the workstation listings, as the choices that are available are quite broad and don't really aid in these comparisons.

Workstation I	Workstation II	Workstation III
12-MHz 286 clone	16-MHz 386SX clone	25-MHz 386 clone
1MB RAM	1MB of RAM	4MB
40MB hard disk drive	40MB hard disk drive	80MB hard disk drive
VGA color monitor and card	VGA color monitor and card	VGA color monitor and card
MS-DOS	MS-DOS	OS/2
Microsoft Mouse	Microsoft Mouse	Microsoft Mouse
Ventura Publisher	*Ventura Publisher*	*PM PageMaker*
$1,500 (system and monitor)	$1,900 (system and monitor)	$3,450 (system and monitor)
$ 110 (mouse)	$ 110 (mouse)	$ 400 (2MB extra memory)
$ 500 (*Ventura Publisher*)	$ 480 (*PageMaker*)	$ 200 (80MB drive upgrade)
		$ 375 (OS/2)
		$ 110 (mouse)
		$ 600 (*PM PageMaker*)
$2,110	$2,490	$5,135

Source: *New York Times*, Tuesday Science Section, Advertisements (March 20, 1990).

The latest controversy, of course, centers on IBM's recent decision to support Adobe PostScript on most of its platforms. This will, at worst, cause serious confusion for users. Doubly confusing is that IBM will also support True Type under Presentation Manager and OS/2.

This begs the question: which technology will IBM really support? For the time being, all we can do is wait and see. Hopefully, in the long run the user will benefit from the superior technology competition usually spawns.

DTP AND PRESENTATION MANAGER

OS/2 and Presentation Manager offer desktop publishers at all levels the prospect of more creative options, more flexible and cost-effective printing alternatives, further accuracy in screen renditions of their layouts, and real-time interaction with graphics and text that comes from—and should remain in—outside applications.

The ability to forge links to outside applications is crucial to the success of desktop publishing in the OS/2 PM environment. DTP applications that incorporate PM's DDE functionality will draw both medium- to high-end publishers to OS/2. Medium-end desktop publishers—and especially corporate financial publishers—will be able to justify the cost of an OS/2 workstation by gaining direct interaction with tables, charts, and graphs. Although the quality of the interchange is important to such users, it is the accuracy achieved through dynamic linking that will attract them to PM DTP.

The high-end publishing houses, such as magazines, newspapers, and some advertising agencies, will hasten to put OS/2 in their budgets for much the same reason, though the DDE interaction they need is with text and artwork applications. As indicated above, by the time you read this, many of the best illustration and imaging products will have made their way to the Presentation Manager.

Along with DDE, typeset and color-separation output are important to the

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Configurations				
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Desktop Model	KEEN-3302	KEEN-2500	—	PEER-1632
Mini-AT Model	—	—	KEEN-2032	PEER-1630
DRAM on Motherboard	Up to 8MB	Up to 8MB	Up to 4MB	Up to 5MB
32-bit DRAM (max.)	16MB	16MB	16MB	5MB
Cache Memory	64/256KB	64/256KB	—	—
Landmark Rating	59MHz	44MHz	26MHz	20MHz

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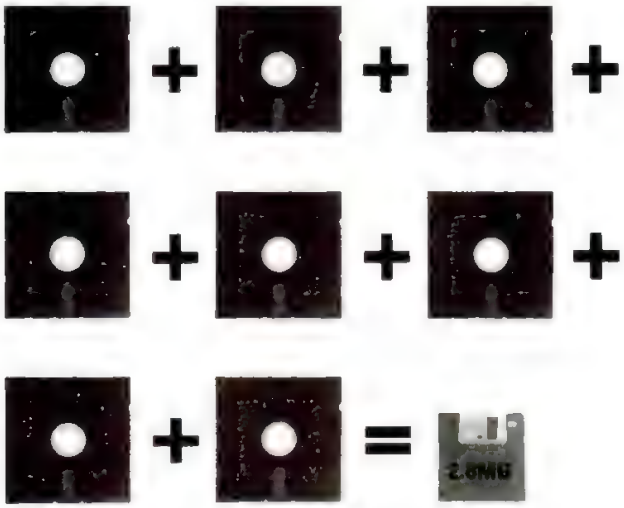

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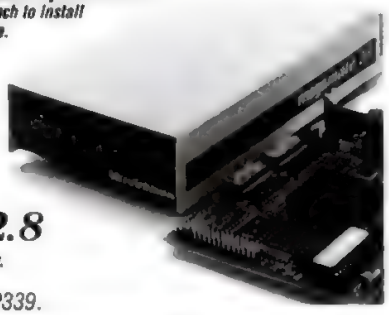

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high-end publishers. Printer driver support must be equal to or better than that on which they've come to rely in their current applications. The implementation of True Type and its ability to read Adobe fonts, as well as PM's ability to download them, will be another required improvement.

Efficient DDE is no less important to DTP ISVs themselves. If viable links can be forged to outside applications, it makes it easier for DTP vendors to determine which features they should include with their products. Many of the common features users currently ask for—for example, a spell checker, thesaurus, search-and-replace functions, and other "code-heavy" baggage—may best be left in the province of the word processor, *if* you can directly interact with it. Similarly, if you look at those recent word processors that attempt to perform DTP functions, you'll find that they perform these functions less efficiently compared with the best DTP applications on the market.

DDE thus offers everyone a better, more efficient publishing environment. It has workgroup written all over it, and that's exactly what in-house publishing is eventually all about.

PREPARING FOR TOMORROW

Unfortunately, the currently released version of OS/2, 1.2, is virtually nonnetwork compatible. Until OS/2 and PM can support popular network environments, especially those on which companies are currently standardized, none of us can yet realize the final dream of truly integrated, multitasking, distributed-processing desktop publishing. Given the hyperfast way things happen in the personal computer industry, however, it's best to begin preparing for that happy future right now.

The first step is to make the move to Presentation Manager–based desktop publishing as soon as possible, for it is clear that the future of DTP is in the PM environment. Before the applications you will eventually want are available—that's the time to begin planning your hardware purchases, so that you're ready for the day when the software finally arrives. And that day is not very far off! ■

Tami Peterson owns Decorum Corp., a New York DTP consultancy, and is a frequent contributor to PC Magazine.

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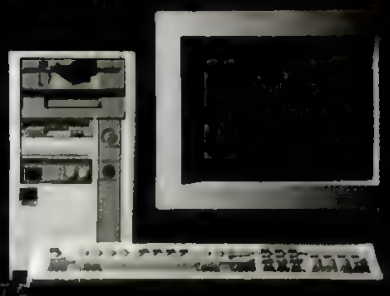

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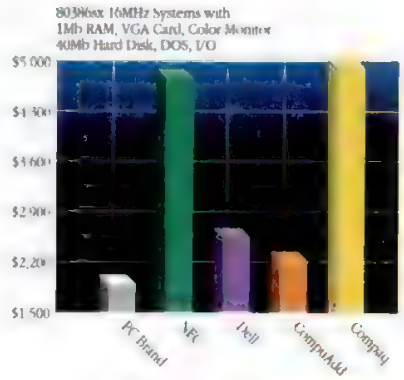

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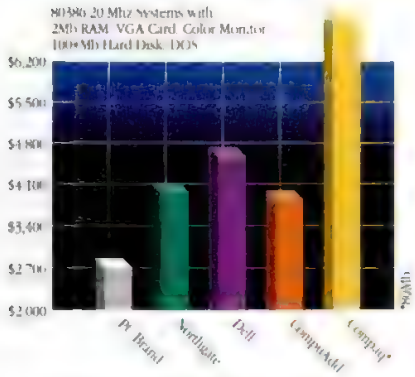

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VGA-Mono	$2229	$2409	$2549	$2999
VGA-Color	$2459	$2639	$2779	$3229
SVGA/Color	$2569	$2749	$2889	$3339

CIRCLE 309 ON READER SERVICE CARD

386/33 CACHE _____ $2299

33 MHz Clock, Zero Wait Operation, Norton SI 45.9 • Landmark 58.7 MHz, 1024K RAM, 1.2MB or 1.44MB Drive, 101-Keyboard, 2 Serial and 1 Parallel Ports

"Here's a price $2799... [Now $2299] Must be stripped to nothing, Right? Wrong...You don't sacrifice quality for low price either. The PC Brand machines are an efficient combination of in-house engineering and top-notch off-the-shelf Parts."

-PC Magazine, 33MHz 386 PC's, October 31, 1989

"...great value. *Period*. ...excellent price performance ratio; high quality."

-Computer Buyers Guide, Product Review, February, 1990

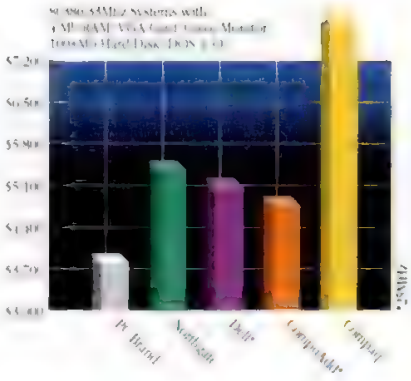
CIRCLE 304 ON READER SERVICE CARD

Standard System Features:

- True 33 MHz INTEL 80386-33 CPU operating w/ Zero Wait States with 58.7 MHz Throughput
- Intel 82385-33 Cache Processor with 32K 25NS Static RAM Standard
- 1024K RAM Standard Expandable to 16MB
- FCC Class "A", Intended for business use
- High performance 16bit VGA Cards with optional 1024x768 capability
- 1.2MB 5.25" or 1.44MB 3.5" Diskette Drive
- 1:1 Interleaving Hard Drive/Floppy Drive Controllers, 1 Mb/Second disk transfer rates on all 40Mb drives or larger
- Enhanced 101-key Click Tactile Keyboard
- I/O Ports-2 serial,1 parallel
- High Capacity 200 Watt System Power Supply
- Real Time Clock/Calendar with 5 Year Battery
- 80387 or Weitek Co-Processor support
- Phoenix BIOS with Full MS/DOS, OS/2, XENIX, UNIX, NOVELL, 3COM compatibility
- EMS and Disk Cache in ROM
- 8 Slot motherboard design
- Medium foot print case w/6 Disk Drive bays

Options:

- Full size Tower® Case w/8 Disk Drive bays
- Low Profile Slim Line Case w/3 Disk bays
- Mini Sized Tower® Case w/4 Disk Drive bays
- Custom configurations w/Name Brand peripherals of your choice
- Factory Installed Ram Upgrades



PC BRAND 386/33 CACHE

with Hard Disk Drive, Monitor & Video Card

Hard Drives: Mb/Ms	40/19	71/25	110/17	200/19
No Video	$2679	$2859	$2999	$3449
Mono	$2799	$2979	$3119	$3569
VGA-Mono	$2979	$3159	$3299	$3749
VGA-Color	$3209	$3389	$3529	$3979
SVGA/Color	$3319	$3499	$3639	$4089

Turn the page for Portables & Peripherals

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PC Brand, Inc. 954 W. Washington St. Chicago, IL 60607 Canadian Fax # 312-633-2888 Canadian Voice # 312-226-5200 We are open Mon thru Fri 8am to 6pm Central Time MasterCard VISA Discover Checks and Approved P.O.s are Accepted. Prices and specifications subject to change. **PCM 9-13**

The Industry's Most Flexible Casing Options

How many times did you wish that your computer were just a little smaller. How about space for another disk or tape drive? Or just one more I/O slot to add that scanner board, fax card or modem?
And remember that time when you needed just another few hours in the day to get that project done and couldn't take your system home or to a Client's?

PC Brand recognizes that many users have unique needs. The standard desktop machine is always a compromise that does't fit everyone.
To us, our Client's needs always come first, so we offer the largest, most flexible series of enclosure alternatives available in the industry today.

Slim Line

Neat, compact, attractive and versatile; our Slimline desktop case offers the ideal solution for the Executive's desk where both footprint and appearance are important, or the Entry station where space is at a premium. Available in configurations ranging from entry level Diskless 286/12 workstations up through top of the line performing 386's with over 200Mb of disk storage, this unit sacrifices little to achieve its goals of clean design and small size.

Desk Top

Unlike the conventional 'Clone' cases found in the market, our Standard full sized desk top case is the first of an entirely new generation. This case fully integrates the lessons learned in the last 5 years of PC history. Full 8 slot I/O, 6 Drive bays and a 200 Watt PS/2 style compact Power Supply result in maximum configurability across our full line of system/drive and video applications, where a desk top placement is desired.

Mini Tower*

Where your application requires more drives or I/O slot configurability than offered with our Slim Line case, but small footprint, attractive design and desk top placement are still required, our Mini Tower* Case is the solution.

Server/Multi-User Tower*

Our Server/Multi-User Tower* case has been designed for Local Area Network and other Multi Terminal applications which typically call for massive Disk storage, maximum I/O card slot usage, high total system power consumption and enhanced operational security. It's larger size, cable routing facilities, enhanced power supply, extra cooling and push button security features have all been optimized around the needs of these systems.

Rack Mount & Custom Cases

Rack mount and other custom enclosures can be configured to your specifications by our special bid desk.

CIRCLE 310 ON READER SERVICE CARD

*Tower is a registered trademark of NCR corporation

Server/Multi-User Tower*

Physical Specifications

Dimensions: 7.5"W x 25.5"H x 17.9"D

Construction: 1.4mm Heavy Gauge Zinc Plated Steel, Slide-In Top

Weight: 47.3 Lbs

Functional Specifications

I/O Slots: 8 total featuring: 8 full length 16-bit or 8-bit

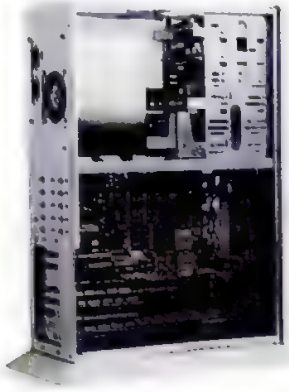
Drive Support: 6 total disk or tape drives mounted as follows: 4 Exposed 5.25" 1/2 Height 2 Internal 5.25" 1/2 Height (all bays can be used for 3.5" drives also.)

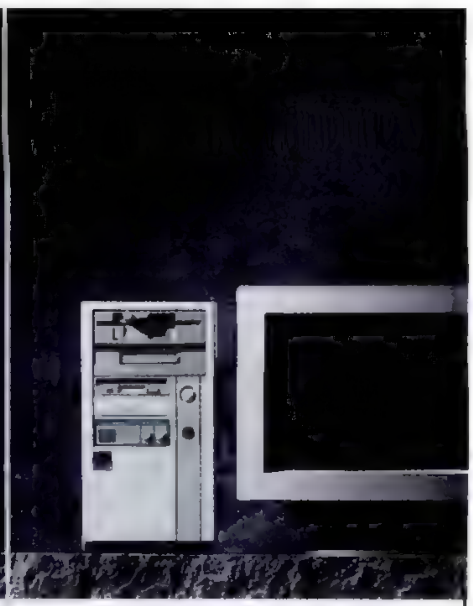
System Power: 220 Watt U/L Heavy Duty

Indicators: Turbo Speed Numeric Indicator, Hard Disk, Activity LED, Power On LED

Switches: Power *On* on front of case, Turbo Speed Change Push Button, System Reset Push Button, Keyboard Key Lock

Special Push button cover to protect against accidental activation of either turbo or reset buttons.





Slim Line

Physical Specifications

Dimensions: 17.1"W x 4.25"H x 16.8"D

Construction: 1.2mm Heavy Gauge Zinc Plated Steel, Slide-In Top

Weight: 26.5 Lbs

Functional Specifications

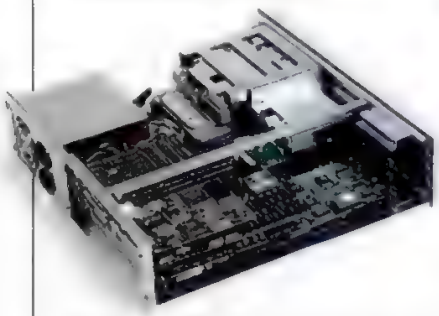
I/O Slots: 5 total mounted on 90 degree rotated adapter tree inserted into main system board 16-bit slot featuring.
2 full length 16-bit
1 half length 16-bit
2 half length 8-bit

Drive Support: 3 total disk or tape drives mounted as follows.
1 Exposed 5.25" 1/2 Height
1 Internal 5.25" 1/2 Height
1 Exposed 3.5" 1/2 Height

System Power: 200 Watt U/L PS/2 Style

Indicators: Turbo Speed LED, Hard Disk, Activity LED, Power On LED

Switches: Power *On* on front of case, Turbo Speed Change Push Button, System Reset Push Button



All photographs above feature PC Brand 386 Series motherboards configured with maximum options to demonstrate the capabilities of each specific case

Certain I/O, drive, and power cables have been removed to improve visibility of components

Desk Top

Physical Specifications

Dimensions: 18.9"W x 6.5"H x 15.9"D

Construction: 1.4mm Heavy Gauge Zinc Plated Steel, Slide-In Top

Weight: 40.5 Lbs

Functional Specifications

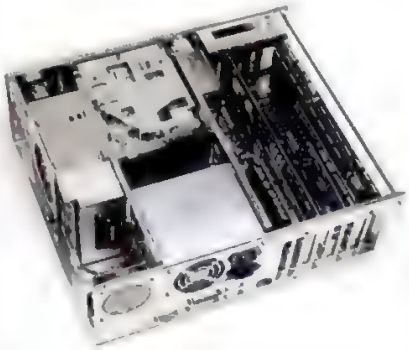
I/O Slots: 8 total featuring.
8 full length 16-bit or 8-bit

Drive Support: 6 total disk or tape drives mounted as follows
2 Exposed 5.25" 1/2 Height
2 Exposed 3.5" 1/2 Height
2 Internal 5.25" 1/2 Height

System Power: 200 Watt U/L PS/2 Style

Indicators: Turbo Speed LED, Hard Disk Activity LED, Power On LED

Switches: Power *On* on front of case, Turbo Speed Change Push Button, System Reset Push Button, Keyboard Key Lock



Mini Tower

Physical Specifications

Dimensions: 7"W x 12.9"H x 15.9"D

Construction: 1.2mm Heavy Gauge Zinc Plated Steel, Slide-In Top

Weight: 25.6 Lbs

Functional Specifications

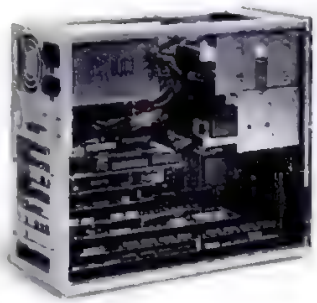
I/O Slots: 7 total featuring:
7 full length 16-bit or 8-bit 1 half length 16-bit or 8-bit

Drive Support: 4 total disk or tape drives mounted as follows:
2 Exposed 5.25" 1/2 Height
2 Exposed 3.5" 1/2 Height

System Power: 200 Watt U/L PS/2 Style

Indicators: Turbo Speed Numeric Indicator, Hard Disk, Activity LED, Power On LED

Switches: Power *On* on front of case, Turbo Speed Change Push Button System, Reset Push Button, Keyboard Key Lock



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CIRCLE 311 ON READER SERVICE CARD

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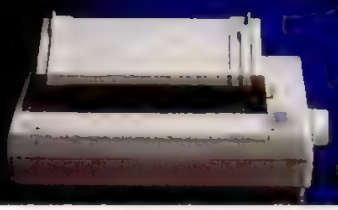
NEC Multisync 2A 14" SVGA
$479

Epson LQ 510 $289



Monitors

Cornerstone Technology
19" Dualpage Display/16 level $1950/2795

Mitsubishi
1381 14" Diamond Scan (to 800x600) $499
HL6605 16" SVGA/EGA (to 1280x1024) 1199
HL6905 20" SVGA/EGA (to 1280x1024) 2095

NEC
GS-2A 14" MultiMono (to 800x600) $249
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3D 14" SVGA/EGA (1024x768I) 649
4D 16" SVGA/EGA (1024x768) 1150
5D 20" SVGA/EGA (1280x1024) 2350

Panasonic
C1391 PanaSync (to 800x600) $489
M1500 15" Mono DTP with adapter 1208
M1900 19" Mono DTP with adapter 1498

Princeton Graphics
Max15 14" Mono (to 1024x768I) $249
UltraSync 14" SVGA/EGA (800x600) 520
UltraSync 16" SVGA/EGA (1024x768) 879

Princeton Publishing Labs
Multiview 15" Mono DTP w/adapter $690

Relisys
9503 14" VGA Mono (640x480) $145
9513 14" VGA Color (640x480) 369
1520 15" SVGA (1024x768) 679

Samsung/Leading Technology
14" VGA Color .31DP (640x480) $369
14" VGA Color .41DP (640x480) 299
14" SVGA Color (to 1028x768I) 419

Seiko
1440 14" SVGA (1024x768I) $599

Sony
Multiscan HG 14" SVGA (to 1024x768) $689
GDM 1606 16" CADD (1280x1024) ..... Call
GDM-1953 19" CADD (1280x1024) ..... Call

Zenith
ZCM1492 VGA Flatscreen (640x480) $619

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VGA Wonder 256K/512K $249/297

Cardinal *PC Magazine's Editors Choice*
VGA 100 8 bit 256K (800x600) $109
VGA 500 16 bit 256K (1024x768) 175
VGA 600 16 bit 512K (1024x768) 209

NEC *PC Magazine's Editors Choice*
Graphics Engine 16 (1024x768) $679
Graphics Engine 256 (1024x768) 969

Paradise
EGA Autoswitch 480 ..... $99
VGA 1024 with 256K 199
VGA 1024 with 512K 259
8514/A Plus ..... 569 VGA Upgrade 199

Video Seven
1024i VGA with 256K/512K $239/299
VRAM VGA with 512K 469

PC Magazine's Editors Choice
Cardinal VGA Cards

PC MAGAZINE EDITORS CHOICE

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8 bit 256K . $109

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16 bit 256K . 175

VGA 600
16 bit 512K . 209

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2400ETC Internal with MNP5 ..... $165
2400ETC External with MNP5 205

Hayes
1200B Internal with Smartcom $189
2400B Internal with Smartcom 249
1200 External ..... 285 2400 External 359

PC Brand (*100% Hayes Compatible*)
1200 Internal with software $49
1200 External ..... 70 2400 External 129
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Courier HST/V.32 External 995
Courier HST 9600 Internal 579

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Complete Communicator 549
Complete Portable Fax 9600 309

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80387-16 ..... 349 80387-20 399
80387-25 ..... 479 80387-33 599

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Abacus 20/25/33 ..... Call

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1.2M 5.25" Half Height Grey 85
1.44M 3.5" Half Height Grey 95

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Bridge-File 3.5" 720K/1.44MB External 229
Bridge-File PC/AT Adapter 59

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Compaq/Conner IDE Upgrades
40M 28ms ..... $459 100M 25ms $679
200M 19ms 1249

Iomega
B1201 20M Int. ... $765 B1441 40M Int. .. $995
B244X Dual 5.25 44M External 1995
PC2/50 NonbootableCard 169
PC2B/50 Bootable Card 230

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Hardcard 40 8 bit or 16 bit 599
Hardcard 80 16 bit 695

Seagate
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20M 35ms ST138 Half Height 229
30M 35ms ST138 Half Height 245
40M 28ms ST251-1 Half Height 319
40M 24ms ST151 Half Height 419
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Maynstream 2200HS 2.2GB Portable 4350

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DJ-10 Jumbo 40/80MB Internal $249
KE-10 External Chassis Kit with Interface 139

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Aboveboard Plus I/O 469
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Inboard 386 AT with 0K 859

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Microsoft
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Programmer's Library 295

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Clipart 3D ..... 285 Image Folio 285

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DMP61DL ..... DMP62 ..... DMP62DL
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CIRCLE 306 ON READER SERVICE CARD

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LC890	3190	LC890XL	4495
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PC500 16 Bit for WS/Server	260/335
PC550 16 Bit Tw. Pr. for WS/Server	291/355
PCZ70E Twisted Pair	139
PC130 Arcnet Board	117
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505UTP Transceiver	$139
1000 Conc./2500 Workgroup Conc.	2575/839

Tiara

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Lancard/E 16 bit Ethernet Twisted Pair	339		
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Ethercard+ PS/2	285	/EPB PS/2	285
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Ethercard+ 16 bit	255		

Xircom

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Pocket Ethernet Adapter Twisted Pair	489

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Netback	$189	Monitrox	$505

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Digiboard

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Wyse Terminals

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(Call for Keyboard options)

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dBase IV	479	Microrim R:Base	489
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Deskview 386 v. 2.2	125		
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Microsoft Excel 2.1	309		
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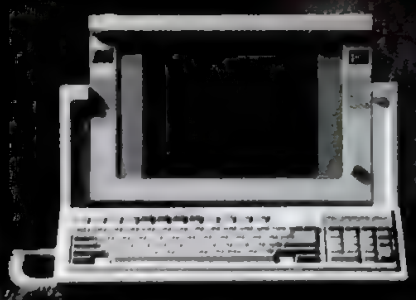

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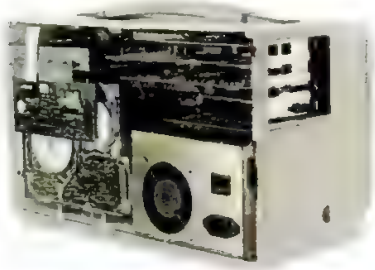

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by
Douglas Boling

Utilities

PMVIEW: A Presentation Manager File Browser

If you've already braved the transition to OS/2, you know how much more productive your machine can be. The Presentation Manager is the environment that *Microsoft Windows* ought to have been—an easy-to-learn user interface that doesn't make you wait for one program to finish before you can begin working on another. Gone are such old DOS bugaboos as RAM cram, the extended/expanded memory division, and TSR conflicts.

Gone too, however, are all those nice little DOS utilities you knew, loved, and used so often. They just don't work under OS/2; a whole new set must be written to replace them. One such utility everyone needs is a file browser, which allows you quickly to view a file without entering a large, clumsy editor. This issue's utility, PMVIEW, is a Presentation Manager–based file browser that lets you look at your files either as ASCII text or in hexadecimal. A search feature is provided to quickly find that needed phrase, and you can also jump directly to any location within the file.

As a Presentation Manager program, PMVIEW displays files in a movable, resizable window. Both window colors and font size are configurable. Scroll bars are provided for mouse-based navigation through the file, but are removable for keyboard-bound users. As with all PM programs, multiple copies of PMVIEW can be run simultaneously.

As you might want to start PMVIEW now and use it later, a command-line switch is provided that automatically shrinks PMVIEW down to an icon on start-up. The name of the file being viewed is displayed in the title bar of the window and also as the title of the icon when the window is minimized.

GETTING AND USING PMVIEW

The details on downloading a fully compiled copy of PMVIEW from PC MagNet are given in the sidebar "PMVIEW by Modem." The source code (which is written in C) and its ancillary files may also be down loaded from PC MagNet. The specific files that you need to create this utility for yourself are PMVIEW, PMVIEW.C, PMVIEW.DEF, PMVIEW.DLG, PMVIEW.H, PMVIEW.ICO, and PMVIEW.RC. You should note that this requires OS/2 1.2 using the IBM or Microsoft OS/2 Presentation Manager Toolkit, as well.

■ Replacing a handy DOS utility with its up-to-date PM counterpart shows how easy OS/2 can be for users and application programmers alike.

The program syntax is very simple:

```
PMBROWSE [filename] [/i]
```

To invoke PMVIEW either from an OS/2 window or from a full-screen command line, just type PMVIEW, followed by the name of the file you want to view. Alternatively, as shown in Figure 1, you can add PMVIEW to a group under the Program Manager that you can then start simply by clicking on the appropriate item in that menu. If you do not enter a filename, a dialog box window will open and prompt you for it. This dialog box lists the drives, directories, and files on the disk, as exemplified by Figure 2. You can simply wander through the list of files until you find the one you want.

By including the optional /i switch on the command line (or as a parameter from the Start Programs menu), you can tell PMVIEW to shrink immediately to an icon. This option is valuable because it allows you to load a frequently referenced file into PMVIEW and minimize its window so that it's at your disposal at the click of a mouse button.

Once a file has been selected, a window appears that displays the file in ASCII text format. You can change this to display the file in hex notation. This option is shown in Figure 3. As with most PM programs, PMVIEW is consumately easy to learn because its features are displayed right on the menu bar.

The two selections under the Search menu let you quickly move to different parts of the file. To find a specific phrase, select the Find selection and a dialog box will appear in which you enter the search phrase. Selecting the Goto option lets you jump directly to an offset within the file.

The Display menu, shown in Figure 4, allows you to customize various aspects of the display format without entering a dialog box. The Configure option brings up a dialog box for picking the color of the screen, the size of the font, the display format, the tab stop value, and whether or not the scroll bars should be shown. Your selections can be saved to disk so that PMVIEW will use the same configuration the next time the program is run.

The help menu has a selection to display the About Box, which, as usual, contains the name of the program and its author, together with the copyright information.

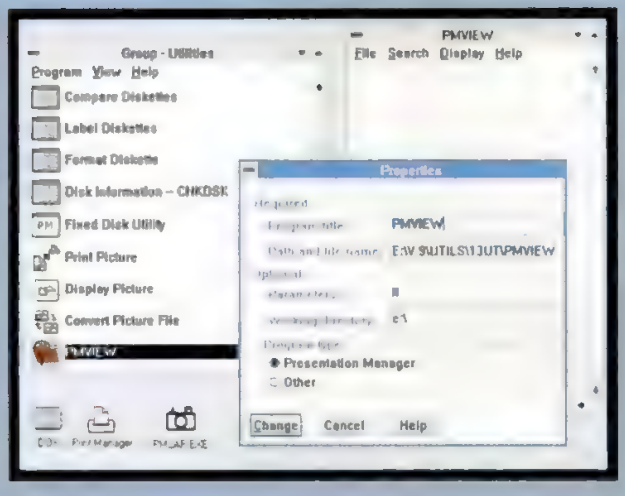

Figure 1: You can add PMVIEW to a menu group under the program manager; execute the utility by clicking the appropriate item in the menu.

PM PROGRAMMING

Creating a PM program is in some ways more involved than writing a program for DOS. PM programs are usually written in a high-level language (normally C) rather than in assembly language, and the programmer needs the OS/2 Toolkit sold by Microsoft and IBM. While the cost of the Programmers Toolkit is by no means negligible, the tools included are invaluable to a PM programmer.

The Toolkit provides not only the proper binding files to call the OS/2 Application Program Interface, but it also includes programs that help you create icons, new fonts, and dialog boxes. Probably the most valuable feature of the Toolkit is the extensive documentation it provides. In the OS/2 1.2 Toolkit, this documentation is presented both in hard copy manuals and in a surprisingly convenient on-line form.

One of the nice features of PM programming is the implicit structure the system encourages. PM programs are naturally broken into the functions necessary to implement various windows. Just as a window is created, written to, resized, and destroyed, so a PM program is composed of functions that respond to these events. Since all PM programs are written this way, reading them becomes much easier.

PM programs are divided into *procedures* that control the various aspects of the program. There is a `main` procedure that receives control of the program when it is run and there is a procedure for each window in the program. Since each type of window has its own procedure, each window reacts to events in its own way.

The `main` procedure must perform a set routine of functions to establish the necessary structures for the program. This litany begins by registering with the Presentation Manager and creating a message queue. The message queue is vital, for this is the way in which the system communicates with the program. A window *class* is created that defines the properties of the application window. The class also tells PM the address of the procedure that controls the window. Once the class is defined, multiple copies of the window can be created, but all windows of the same class will be handled by the same window procedure.

One of the nice features of PM programming is the implicit structure the system encourages.

After its initialization work, the `main` procedure spends its time simply reading messages from the message queue and dispatching them to the window procedures. As the function of this structure implies, most of the work in a PM program is handled by the individual window procedures. The strength of this design is that each window procedure needs to concern itself only with the function of its window; it doesn't have to worry about other events or windows in the system.

The function of a window procedure is to respond to messages sent to the window. These messages can come from the system, can be sent from other windows, or can even be sent by the window procedure itself. As there are approximately 100 messages, programming responses to all of them would be quite a job. But fortunately, the system provides a default procedure that can respond to all messages properly. Consequently, an individual window procedure can simply pass any message that it does not process itself onto the default window procedure.

Since messages are the PM's method of communication, it is important to understand the concept of messages. While a message-based environment makes a program amazingly easy to write, it does force you to rethink the way you write your program. Instead of your writing procedures to query the system for keys and mouse movements, or to check whether you need to write to the screen, the system sends you messages to tell you that these events have happened. In fact, a window procedure does nothing but react to the messages it receives.

For example, when a window is created, its window procedure receives a message indicating that a window has been created. If a window is resized, a size message is sent. If a window is uncovered and needs redrawing, a paint message is sent. When a window is destroyed, a destroy message is sent. Once a message is received, the program reacts to the specific situation on the basis of its current state. The power of this structure is that the code fragment responding to the paint message does not care how the current state was entered, only that the window needs to be redrawn.

Once again, PM programming encourages an easy-to-read compartmental structure. Just as each window procedure needs to concern itself only with its own window, the code to respond to each message needs to concern itself only with that particular message.

Another way in which PM encourages structured programming is in its use of *resource files*. Resource files define the initial structure of the menus and dialog boxes and provide a place to save message strings, as well. Resources can either be

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bound to the executable program at link time or can reside as separate files loaded only as needed.

Resource files allow a programmer to remove the user interface structure from the code and place it in a separate file. This allows the user interface of a program (its dialog boxes, menus, messages, and so forth) to be rewritten without having to recompile the code. This segregation of the user interface provides a simple way to modify a program for a foreign language. It also makes it possible to have the resource file created by the "human factors group" of a development organization. Menus, dialog boxes, and messages can thus be designed and redesigned without impacting the code development.

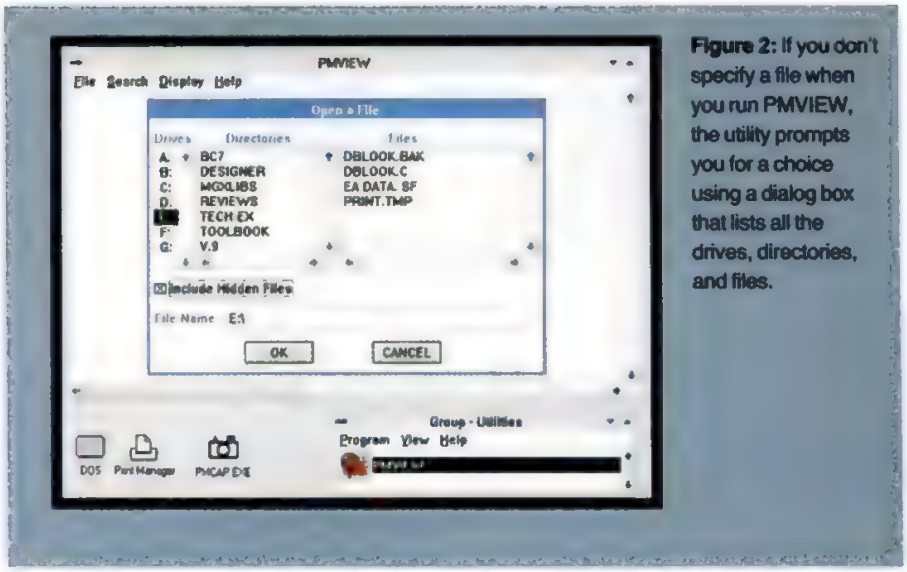

Figure 2: If you don't specify a file when you run PMVIEW, the utility prompts you for a choice using a dialog box that lists all the drives, directories, and files.

THE PMVIEW SOURCE CODE

Once you understand the general structure of a PM program, reading and making sense of PMVIEW.C is very easy. Like all PM programs, PMVIEW has a `main` procedure and a window procedure for each type of window. In the case of PMVIEW, one standard window and a number of dialog box procedures are needed.

The `main` procedure in PMVIEW does more than simply create a message queue and loop. First, it requests a memory segment in which to store the browsed file from the system. The memory buffer control structure is then initialized. The system is queried using WinQueryProfileData to retrieve any profile data previously stored by the program. Finally, the command line is parsed to determine the name of the file to browse and whether the program should initially be minimized to an icon.

The window class is registered with the system by calling WinRegisterClass. This call provides the parameters for the window class and a pointer to the client window procedure.

The window is created with the call WinCreateStdWindow. This call provides an easy way to create the normal window used by most programs. WinCreateStdWindow can actually create up to five windows. Four of these windows are controlled by system procedures, while the final window, known as the *client window*, is the responsibility of the application program.

The four system-driven windows are the *title bar*, the *system menu*, the *minimize-maximize buttons*, and the *frame*. The frame window is the most important, as it is the *parent* of the other four windows (including the client window). By being *children* of the frame window, the remaining four windows are automatically referenced to the frame. That is, when the frame moves, the children automatically move. Further, child windows are clipped to the parent—that is, they can be seen only within the frame. Thus the frame is an integral aspect of the concept of a standard window.

Window parameters are indicated by a set of flags. Called *Frame Creation* flags, these indicate what *controls* the window has, such as menus, minimize and maximize buttons, a title bar, and scroll bars. The flags also provide the system with guidelines about which messages to send to the window.

Since PMVIEW can either save the window position from a previous invocation or start as an icon, a call must be made to WinSetWindowPos. This call positions and sizes the window and sets the appropriate minimize/restored state.

Once the client window has been created and positioned, the `main` procedure is left with its usual task of reading messages from the message queue and dispatching them to the windows. The loop is terminated when WinGetMsg returns the value of 0. Conveniently, the only message that returns this value is WM_QUIT—the message indicating that the program itself should be terminated.

After the message loop is terminated, any opened files are closed and the memory buffer is released. The client window and message queue are destroyed, the anchor block is released, and the program is terminated.

The client window procedure is simply one large switch statement. The procedure switches on the type of message received. All messages not processed are passed to the default window procedure. Since the structure of the program is divided by the message type, the description of the procedure will also be discussed that way.

The first message received by the window procedure is WM_CREATE. If a filename was not specified on the command line and the minimization was not selected, the file open dialog box is displayed to ask the user for a filename. If a filename was entered, that file is opened using the OpenFile routine. The name, handle, and size of the file is saved in the file information structure.

During WM_CREATE, PMVIEW determines the window handles assigned to the scroll bars, the menu, and the frame. These handles are needed so that messages can be sent to the various windows. The values of the handles are determined by using WinQueryWindow to determine the parent of the client window (the frame window.) A series of Calls to WinWindowFromID with the appropriate flags returns the handles of the remaining windows.

After this, an AVIO space is created. An AVIO space is an area in the computer's memory that appears to the PM program as a virtual text-mode screen. In order to create the AVIO space, a presentation space is first requested using GpiCreatePS. Then the AVIO space is created by using VioCreatePS. The two spaces are

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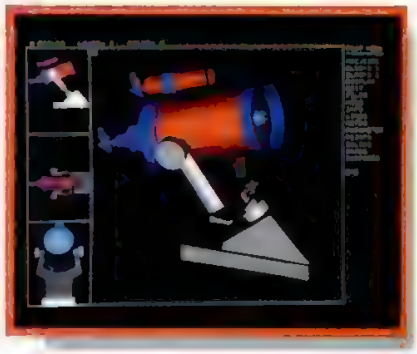

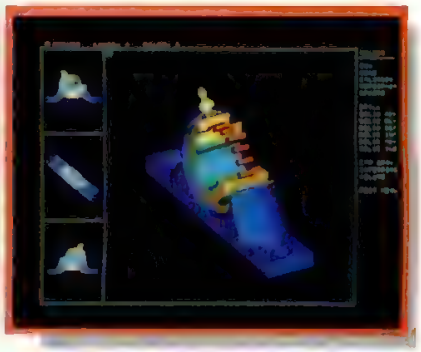

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Figure 3: PMVIEW's file management options are in the menu bar. Search lets you move quickly to a specified phrase or offset with the document. The Display menu lets you customize elements of the screen format.

then associated with VioAssociate.

The video driver is queried to determine the number and sizes of the available cell sizes. Since the AVIO space is a text space, the cell size determines the font size. Two cell sizes are available for EGA and VGA devices, and eight cell sizes are available for the 8514. The cell size read from the profile data is set and then read back. If the cell size saved does not match one available from the driver, the driver makes the closest match it can.

A WM_PAINT message is sent when the system determines that a part of the client window needs to be redrawn. PMVIEW assumes that the entire AVIO space needs redrawing, and the DisplayLine routine is called to write each line to the screen.

The DisplayLine routine writes the contents of the file pointed to by lLinePtr to the line specified by sRow. The file is written as ASCII if the fDisplayASCII flag is set; otherwise 16 bytes of the file are converted from hex to ASCII and displayed.

Routines that need file data, such as DisplayLine, call GetFileDataPtr to return a pointer to a buffer area containing the data. GetFileDataPtr is passed an offset into the file and returns a long pointer to the file data. A limit value, which represents the number of bytes until the end of the current buffer, is also returned. If a routine needs data past the end of the current buffer, GetFileDataPtr is called again with an updated file offset.

PMVIEW keeps four data buffers, which contain the last four regions of the file requested. When GetFileDataPtr is called, it compares the file offset passed with the buffer-control structure to determine whether that part of the file is in memory. If the data is in a buffer, the pointer to that buffer is returned; otherwise, that part of the file is read into the buffer with the least-recently used data.

When a WM_SIZE message is received, indicating that the window has been resized, the new size of the window is recorded and the scroll bars are adjusted. The new size of the window is passed in the mp2 parameter. The thumb size is adjusted by sending an SBM_SETTHUMBSIZE message to both the horizontal and vertical scroll bar handles. The horizontal scroll position is adjusted if the new window size exposes the far-right edge of the AVIO space.

The WM_COMMAND message processing uses the majority of the window procedure: it is here that menu selections are processed. Like the messages, menu selections are parsed using a switch statement. The identity of the item selected is passed in the mp1 parameter. The processing of selections is usually quite simple.

When the File Open (IDM_OPEN) menu item is selected, the file open dialog box is displayed using the WinDlgBox function. The WinDlgBox routine is actually a combination of three functions: WinLoadDlg, to load the dialog resource; WinProcessDlg, to transfer control to the dialog box procedure; and WinDestroyWindow, to remove the window. WinDlgBox provides a simple way to query the user for input. The format of the dialog box is defined in the resource file, and the function of the box is provided by the file-open-dialog-box procedure.

The file-open-dialog-box procedure returns a Boolean value that indicates whether the user selected a file or selected the cancel button instead. If a file was selected, OpenFile is called to attempt to open the file. If the attempt is successful, the old file is closed, and the new name and file handle are placed in the file information structure. WinInvalidateRect is called in order to force a WM_PAINT message to be sent.

When the user selects Exit (IDM_EXIT), to end the program, PMVIEW simply posts a WM_QUIT message to itself. Since the WM_QUIT message returns a FALSE to the WinDispatchMsg function, the message processing loop is exited. Once the message loop is terminated, the main procedure destroys the window and terminates the program.

When Find (IDM_FIND) is selected, a dialog box is displayed to ask the user to enter the search string. If the dialog box returns a TRUE value, the search routine is called to find the string. If the string is found, lViewPtr is updated to the new location and WinInvalidateRect is called.

As with Find, when Goto (IDM_GOTO) is selected, a dialog box is displayed to determine the new view pointer. If TRUE is returned, the view pointer is updated and WinInvalidate is called.

Configure (IDM_CONFIGURE) displays a dialog box to query the user for various parameters—window color, font size, display format, tab stop value, and scroll bar visibility. Upon a successful return from the dialog box procedure, routines are called to set the proper menu attributes and to set the visibility of the scroll bars. Since the format of the display has changed, WinInvalidateRect is called to force the window to be repainted.

Display ASCII (IDM_DISPLAYASCII) sets the display ASCII flag, modifies the menu attributes, and invalidates the window. The SetASCII routine modifies the menu attribute by sending a MMSETITEMATTR message to the menu window. This message defines the attribute to modify—in this case, the check mark—and its new state. This selection and the Display Hex selection are mutually exclusive, so the routine removes the check from the Display Hex selection. WinInvalidateRect is then called to display the new format.

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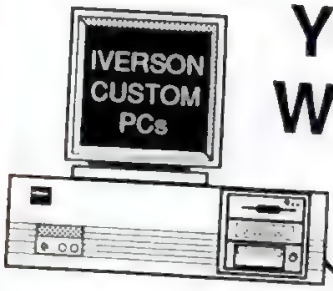

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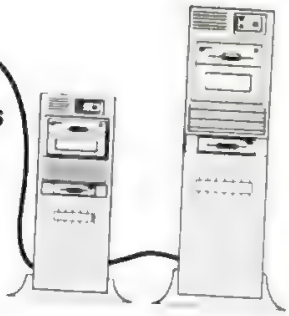

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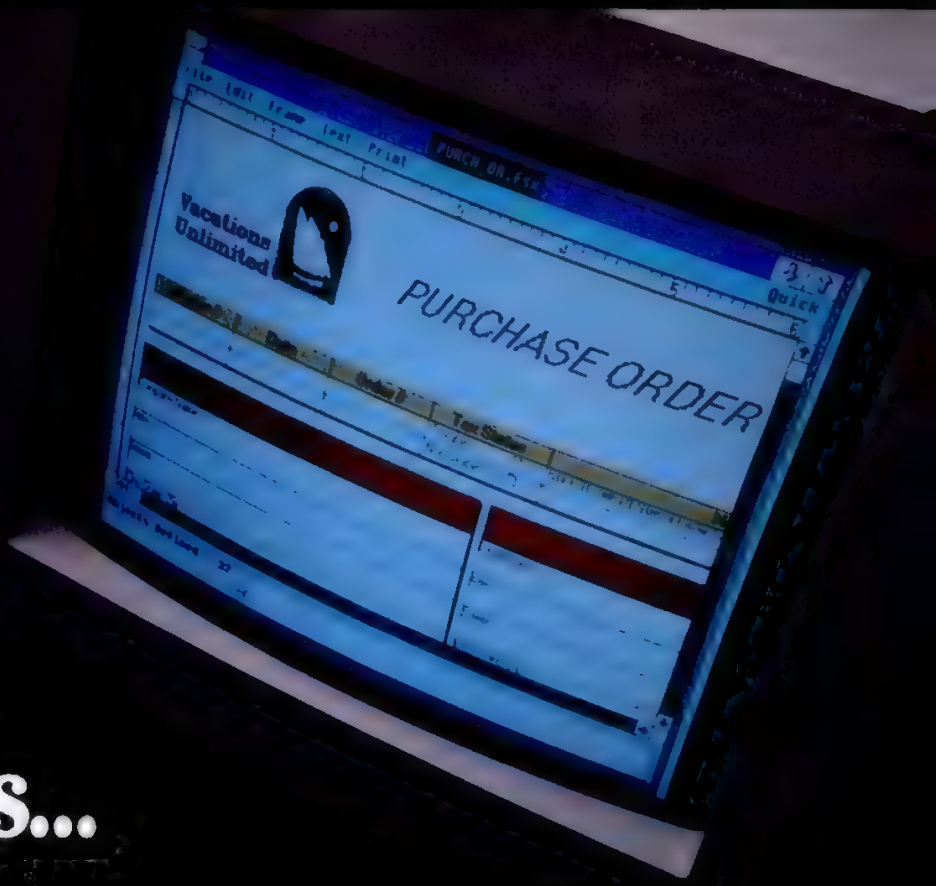

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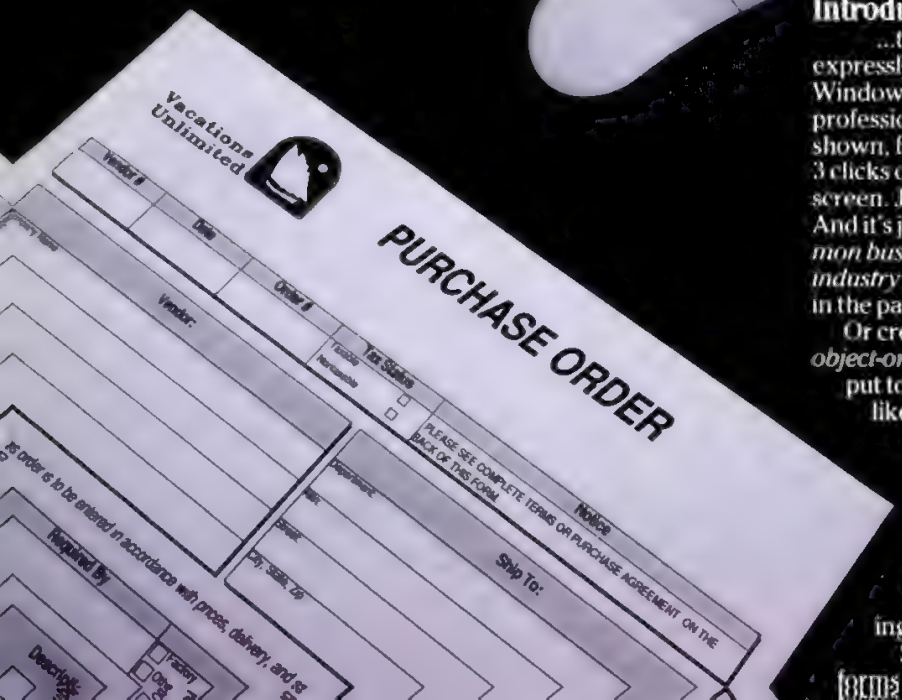

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PMVIEW BY MODEM

The programs published in *PC Magazine* are available by modem from PC MagNet.

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To download PMVIEW.EXE and/or its C language source listing and related files, log on to PC MagNet. Enter GO UTILITIES or choose PC MAGAZINE UTILITIES from the top menu, then DIRECT UTILITY DOWNLOAD from the next menu. Enter the filename, then select the file you want to download from those presented. Answer yes (Y) to DO YOU WISH TO DOWNLOAD? Press Enter to see the transfer protocols. Choose a protocol and download the file.

You don't have to be a member of CompuServe to access PC MagNet. It costs $12.80 an hour for 1,200/2,400-bps service and $6.30 for 300-bps, via MasterCard, VISA, or American Express. These programs can be copied but are copyrighted and are made available only for noncommercial use. You may make copies for others as long as no charge is involved, but making copies for any commercial purpose is prohibited.

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PMVIEW Command

Douglas Boling — July 1990 (Utilities)

Purpose: A file-browsing utility for the OS/2 Presentation Manager. PMVIEW displays files either in ASCII or in hex and permits searching by phrase or jumping directly to a specified point in a file.

Format: `PMVIEW [filename] [/i]`

Remarks: PMVIEW can be invoked either from an OS/2 window or from the full-screen command line. If no filename is entered initially, a dialog box is opened listing the available drives and files from which a file may be selected. PMVIEW can also be made a part of the Program Manager group, in which case it can be selected from a menu at start-up. Adding the optional /i switch, either at the command line or as a parameter of the Start Programs menu, will load PMVIEW with a specified filename and immediately shrink it to an icon, making it instantly available. The selected filename is shown in the title bar of the display window and as the title of an icon when the window is minimized.

Search menu options for PMVIEW permit entering either a phrase or an offset to which the utility will jump. Configuration options permit customizing the screen color, display font size, display format, tab stop setting, and whether or not the scroll bars should be shown. These settings become program defaults, but may be changed at any time.

A fully compiled copy of PMVIEW.EXE can be downloaded from PC MagNet, as can the source code (in C) and related files. Users who wish to create or modify their own copy of PMVIEW are advised that they'll need OS/2 1.2 and OS/2 Presentation Manager Toolkit (from IBM or Microsoft).

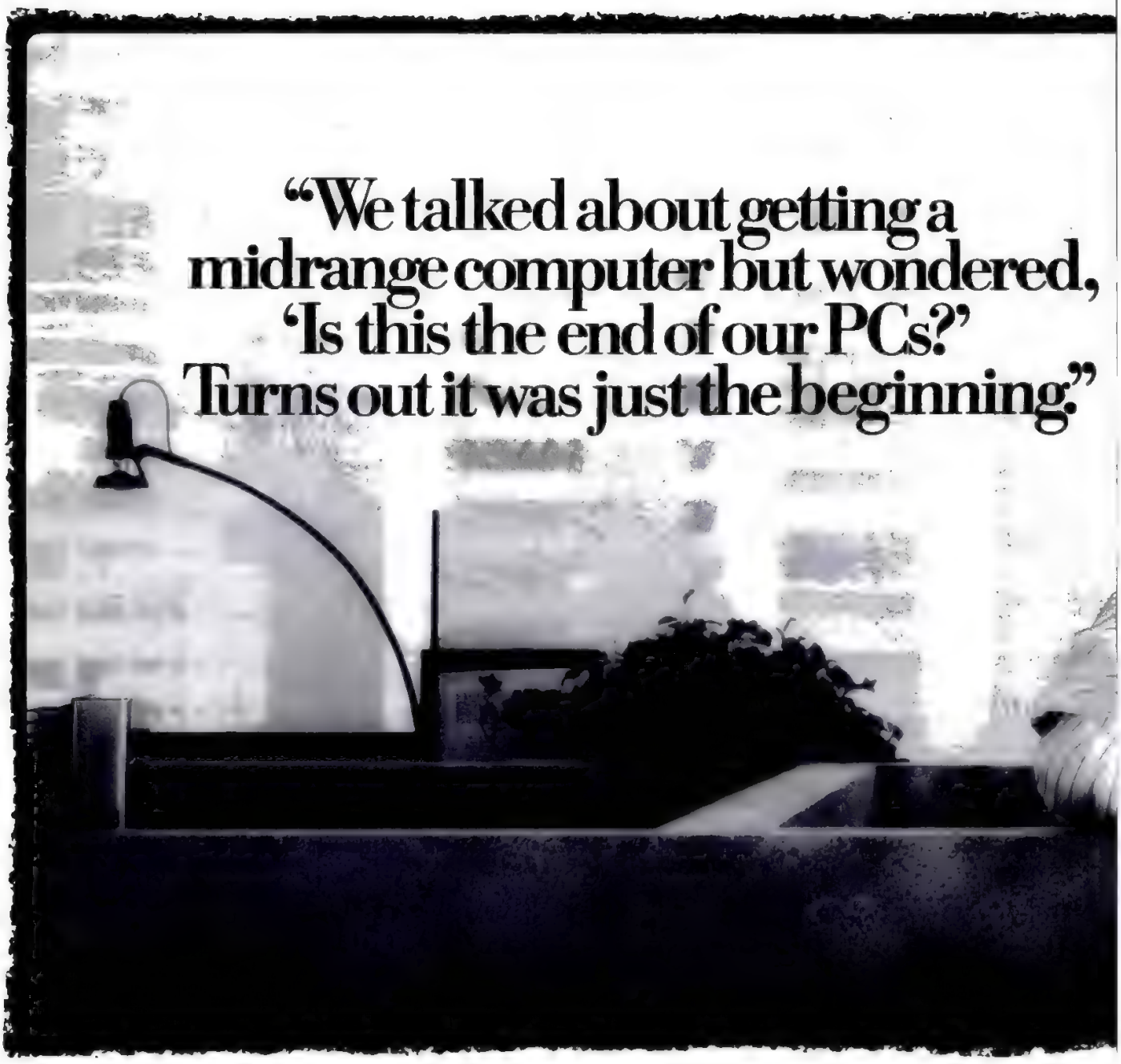

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Figure 4: While the Display menu lets you make simple formatting decisions without using a dialog box, it also lets you make more-complicated choices through the Configure option. Configure lets you control color, font size, and tab lengths, among other selections.

The Display Hex (IDM_DISPLAYHEX) selection has the same function as the Display ASCII selection, but the Display ASCII flag is cleared. As above, the window is invalidated to produce a repaint that will show the new format.

The Scroll Bar selection (IDM_DISPSCROLLBARS) toggles the visibility of the window scroll bars. To hide the scroll bars, PMVIEW sets the parent of the scroll bars to HWND_OBJECT. The frame is then updated. Since the scroll bars are no longer children of the frame, they are overwritten by the client window. To restore the scroll bars, a message is sent to reset them as children of the frame window. As in the Display ASCII selection, the menu is updated with a check mark to indicate the status.

The Font Size selection (IDM_FONTSIZE) is of interest because the text of the menu is actually modified according to the state of the window. For CGA systems the selection is disabled, since there is only one AVIO cell size. On EGA and VGA systems, two font sizes are available. The menu item for these systems is set to Small Font when the large cell size is enabled and to Large Font for the small cell size. On 8514/A systems, the menu selection is Font Size. Selecting the item displays a dialog box with the possible cell sizes listed in a list box. The cell size is changed by calling VioSetDeviceCellSize.

The About selection under the help menu simply displays a dialog box that contains program information. The About dialog box demonstrates how simple a dialog procedure can be.

WM_CHAR messages are received each time the user presses a key. PMVIEW ignores all keys, however, except those needed for scrolling the file. There is no need to interpret the accelerator keys for the menu items, since an accelerator table is defined in the resource file. PM translates accelerator keys into menu selection messages automatically. To simplify the keyboard processing still further, when cursor and page keys are received, PMVIEW simply posts messages to the appropriate scroll bar window so that these are processed as scroll bar events. Thus, the only two keys directly interpreted by PMVIEW are the Home and End keys. These two keys cause the File View pointer to be updated (to 0 or to the file size) and further cause the window to be invalidated, then repainted.

The scroll bars communicate to the client window by sending WM_HSCROLL and WM_VSCROLL messages. For both of these messages, mp2 contains the event to process.

PMVIEW handles horizontal scrolling simply by panning across the AVIO space. DisplayLine writes a line to the next carriage return or to the end of the presentation space, regardless of what part of the space is visible. To pan across the AVIO space VioSetOrg is called to adjust the starting column of the AVIO space to display.

Vertical scrolling is handled by scrolling the AVIO space the necessary number of lines, then calling DisplayLine to fill in the lines made vacant. The MoveViewPtr routine is called to determine the number of bytes to move the view pointer forward

PC UTILITIES UPGRADES

Like all good software, the programs presented in *PC Magazine* are upgraded and improved. The only way to obtain the modified versions is to download them from PC MagNet. Here is a partial list of the programs that have been upgraded to fix minor bugs and system incompatibilities:

ANSI.COM, Version 1.3
CARDFILE.COM, Version 1.1
CHKFRAG.EXE, Version 1.2 (now works with volumes greater than 32MB)
DIRMATCH.COM, Version 2.0
EMS40.SYS, Version 1.1 (fixes a problem that EMS40 had with *Lotus 1-2-3*)
LITES.COM, Version 1.1
LOG.COM, Version 1.1
MENU.COM, Version 1.1
RN.COM, Version 2.0 (now works under DOS 4.*x*)
SLICE.COM, Version 1.3
SNIPPER.COM, Version 1.2
ZCOPY.COM, Version 1.2

For a complete list of all the programs available from the PC MagNet Utilities Database, download UDCAT .ARC.

A downloadable index to *PC Magazine*'s product reviews is also available. PCM.EXE is a self-extracting file that contains the *Computer Library PC Magazine* Reviews Index for January 1988 to December 1989. This easy-to-use database is a subset of *Computer Library*'s Periodicals Database, which is available on CD-ROM and on PC MagNet. It requires the search files in PCSRCH.EXE.

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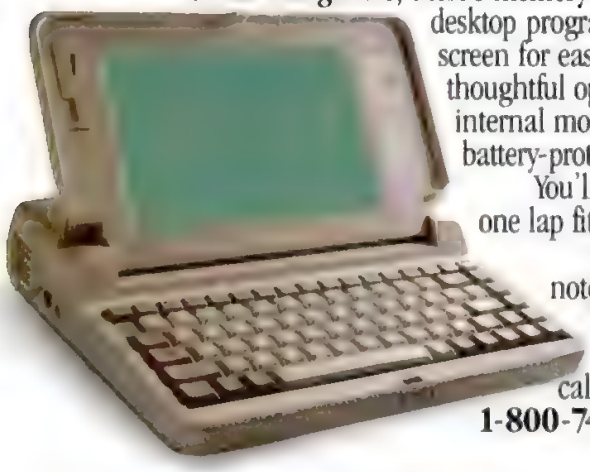

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or backward. MoveViewPtr counts the number of carriage returns if displaying ASCII characters, or counts blocks of 16 bytes per line, if in hex mode.

A WM_DESTROY message is sent when the client window is about to be destroyed. When this message is received, the AVIO space is disassociated from the presentation space and both are then destroyed.

Just as the client window has a procedure to accomplish its functions, so each dialog box has a dialog box procedure. In PMVIEW the dialog procedures range from the almost trivial About dialog box to the fairly complex File Open and Configure dialog procedures. Dialog procedures are interesting in that there is much more interaction with controls such as buttons, list boxes, and entry fields. As with almost everything else in PM, controls are simply windows that are communicated with using messages. Each control has a defined set of messages that it recognizes and sends.

Resource files are a great timesaver for the application programmer. Since the arrangement of menus and dialog boxes is defined by a set of tables, they can be rearranged or supplemented quickly. For PMVIEW, the resources are divided between the PMVIEW.DLG file, which describes the configuration of the dialog boxes, and PMVIEW.RC, which describes the menus and accelerator table. PMVIEW.DLG is included in the resources via an include statement in PMVIEW.RC.

OS/2: A CLEAR WINNER

PMVIEW shows that a powerful Presentation Manager program, though complex in outward appearance, can really be written easily by a competent programmer. Since PM performs the difficult jobs, an application program has to concern itself only with its unique function. Mundane procedures such as screen handling and keyboard reading are a thing of the past.

While the future of OS/2 is argued by the industry pundits, to the application programmer the choice is clear: the power of the PM programming environment makes OS/2 a big winner. Now for some more of those utilities to replace! ■

Douglas Boling is a contributing editor of PC Magazine.

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Buyers seeking computers for use in homes (including offices at home) should shop for computers and peripherals which have been Class B certified. These devices carry a label with an FCC ID number. Both new and used Class A verified devices may be sold only for use in commercial and industrial locations. Signals from computers are more likely to be masked by electrical noise from other equipment in such an environment. These areas are also likely to have fewer radios and TVs. Accordingly, equipment marketed only for use in these locations may meet the less rigorous Class A standard. Class B certified equipment may be marketed for use in residences as well as commercial and industrial locations.

As you shop for a computer for use in your home, look for the FCC classification in the specifications or ask your vendor to recommend only machines that have been certified to the Class B limits. TV viewers and radio listeners in your home and in neighboring homes will be glad you did.

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by
Charles Petzold

Environments

How to Create a Multithreaded Mandelbrot Program

■ The world of fractals provides a fitting climax to this series on multithreaded drawing under the OS/2 PM.

Computer graphics is the meeting place of mathematics, art, and digital processing. Nowhere is this more obvious than in that area of mathematics and geometry that deals with *fractals*.

Although the origins of fractal geometry date from precomputer times, the field has blossomed in recent years largely because of the computer. While fractal images can often be described with mathematical formulas, visualization makes them come alive. The construction of fractal images requires a very large amount of computation.

OS/2 provides a good environment for studying fractals on a personal computer for several reasons. First, OS/2 can multitask. While a fractal program is grinding away, you can work at something else on the machine. Second, the device-independent graphics interface of the OS/2 Presentation Manager provides a way for a program to draw fractal images on a video display without taking the video display hardware into account.

In the past several Environments columns, I've discussed ways in which Presentation Manager programs can draw from a second thread of execution. A PM fractal program (more specifically, a program that draws the famous Mandelbrot set), PMMANDEL, is a fitting conclusion to this series.

Unfortunately, the source code for PMMANDEL is a bit too long to print here, but you can download both the source code and the executable file from PC MagNet on CompuServe. Because fractals are becoming an increasingly important part of computer graphics programming, I will focus primarily on an overview of fractal geometry. I'll take a look at some of the programming details toward the end of the column.

WHAT IS A FRACTAL?

The term *fractal geometry* was coined by Benoit Mandelbrot. Mandelbrot was born in Warsaw in 1924, moved to Paris in 1936, and then to America in 1958. He is now an IBM Fellow at the Watson Research Labs in New York, and a professor of mathematics at Yale. A summary of Mandelbrot's work on fractals can be found in his *The Fractal Geometry of Nature* (W. H. Freeman and Company, 1983).

We are all familiar with the use of the word *dimension* to describe objects. A point has zero dimensions, a line has one dimension, an area has two dimensions, and a solid has three dimensions. Mandelbrot calls this last the *topological dimension*.

A fractal has a quality called a *fractal dimension* that is larger than the topological dimension. (A nonfractal object has a fractal dimension that equals the topological dimension.) The fractal dimension is very often a fraction, hence the origin of the word *fractal*.

Fractals are best approached by means of examples. One of the most famous is the Koch snowflake, first constructed by mathematician Helge von Koch in 1904.

MONSTER CURVES

The Koch snowflake is constructed through an iterative process. You begin with a simple equilateral triangle. On each of the three sides of the triangle, you append triangles with sides that are ⅓ the length of the original. Now the figure has six points and 12 sides.

Do it again: on the 12 sides, append 12 triangles with sides that are $^1/_9$ the original length. Now there are 48 sides. On each of those sides, append triangles with sides that are $^1/_{27}$ the original length.

As you continue in this way, something very peculiar happens. First, the area of the Koch snowflake approaches a finite limit. Yet for each iteration, the boundary of the snowflake becomes larger and larger, increasing by ⅓ with each iteration, approaching infinity. The Koch snowflake is a fractal.

The Koch snowflake exhibits another characteristic common in fractals: self similarity. No matter how far you zoom in on the boundary of the Koch snowflake it looks the same.

Mathematicians who created objects such as these were almost afraid of them. They called them *monster curves*. But they were pleased as well, for they thought they had created objects intrinsically different from the objects found in nature.

This belief was mistaken. One of Mandelbrot's major observations is that fractals have very much to do with nature.

THE COAST OF BRITAIN

"How long is the coast of Britain?" Mandelbrot asked. The answer is not at all straightforward.

Using an aerial photograph, you might make one estimate, but down on earth, equipped with a yardstick, you'd find more detail in little bays and peninsulas,

and the length of the coast would seem to be longer. If you were to get on your hands and knees with a ruler 1 inch long and measure around rocks, the coastline would be longer still.

Like the Koch snowflake, a coastline displays self similarity. A line that approximates a mile of the coastline from an aerial view will look pretty much like one that approximates a foot of the coastline as viewed on earth. A boulder looks a lot like a rock, which looks a lot like a pebble, which looks a lot like a grain of sand, depending on your view.

The length of a coastline is infinite; it has a fractal dimension greater than the topological dimension. The coastline is a fractal.

Indeed, it's actually hard to find anything in nature that is *not* a fractal. No matter how much you magnify an object in nature, you still see detail. And do you think that if you finally magnify enough to see individual molecules and atoms, you'll stop seeing detail? Guess again. Brownian motion (which describes the movement of molecules) has a fractal nature.

WHAT ARE THEY GOOD FOR?

Computer graphics systems (such as the Graphics Programming Interface in OS/2) often support several primitives that a program uses for drawing objects. But the images of the natural world are not made up of straight lines, rectangles, circles, ellipses, and Bézier splines.

Fractals—particularly when combined with some degree of controlled randomness—have proved to be extremely useful when computers are required to mimic images of the real world. Fractals can generate realistic landscapes and natural surfaces. Remember the blooming of the Genesis planet in the second *Star Trek* film? That was done with fractals.

Of course, for business applications on the personal computer, fractals seem to have little use. I'd be hard-pressed to describe how your accounting software could benefit from fractals.

But consider computer-aided drawing programs. Suppose an architect wants to simulate a new building on a computer screen. Fractals would be very useful in drawing the surrounding natural environment and the surfaces of the building materials. Shading languages, such as Pixar's RenderMan, use fractals to simulate realistic surfaces, and the effects are often stunning.

Another application of fractals is pure aesthetic pleasure. You may have philosophical problems with the idea that a mathematical algorithm can create a work of art (I certainly do!) but lay that aside as you look at various views of the Mandelbrot set.

THE MANDELBROT SET

Benoit Mandelbrot has had a lot of computer programs named after him, and I'm about to add another. PMMANDEL is a Presentation Manager program that plots the most famous fractal image—the Mandelbrot set.

> The PM program, PMMANDEL, plots the famous fractal image—the Mandelbrot set.

The Mandelbrot set involves complex numbers, which are numbers that comprise a real number and an imaginary number. A complex number is usually represented by

$$z = x + yi$$

where z is the complex number, x is the real part, y is the imaginary part, and i is the square root of −1.

You can add, subtract, multiply, and divide complex numbers. For example, if

$$z_1 = x_1 + y_1 i$$

and

$$z_2 = x_2 + y_2 i$$

then

$$z_1 + z_2 = (x_1 + x_2) + (y_1 + y_2)i$$

and

$$z_1 z_2 = (x_1 x_2 - y_1 y_2) + (x_1 y_1 + x_2 y_2)i$$

You can also represent a complex number on a rectangular coordinate system. The horizontal axis represents real numbers and the vertical axis represents imaginary numbers. Any complex number is a point in this coordinate space.

The Mandelbrot set is plotted on such a complex coordinate space. A particular point on this coordinate space can be represented by the complex number P. For a particular point P in this coordinate space, you start by initializing a complex number:

$$z_0 = 0$$

Then begin an iterative calculation:

$$z_1 = (z_0)^2 + P$$
$$z_2 = (z_1)^2 + P$$
$$z_3 = (z_2)^2 + P$$

and in general

$$z_n = (z_{n-1})^2 + P$$

This iterative calculation results in the following:

$$z_1 = P$$
$$z_2 = P^2 + P$$
$$z_3 = (P^2 + P)^2 + P$$
$$z_4 = ((P^2 + P)^2 + P)^2 + P$$

and so forth.

With enough iterations, z_n may converge to infinity or it may not. For example, if the complex point P is equal simply to the real number 1, then z_n will converge to infinity because it gets larger and larger with each iteration. If the point P is equal to the real number 0, then z_n will not converge to infinity.

If z_n does not converge to infinity, then the point P is part of the Mandelbrot set. If z_n converges to infinity, it's not part of the Mandelbrot set. Now move on to another point P on the complex coordinate space.

(How do you know whether z_n is converging to infinity without performing an infinite number of iterations? It turns out that z_n will converge to infinity if the *magnitude* of z_n ever becomes 2 or above. Recall that a complex number z is

$$z = x + yi$$

The magnitude of a complex number z is

$$(x^2 + y^2)^{1/2}$$

Therefore, you know that z_n will converge to infinity if $(x_n^2 + y_n^2)$ should become

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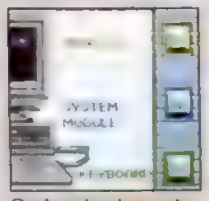
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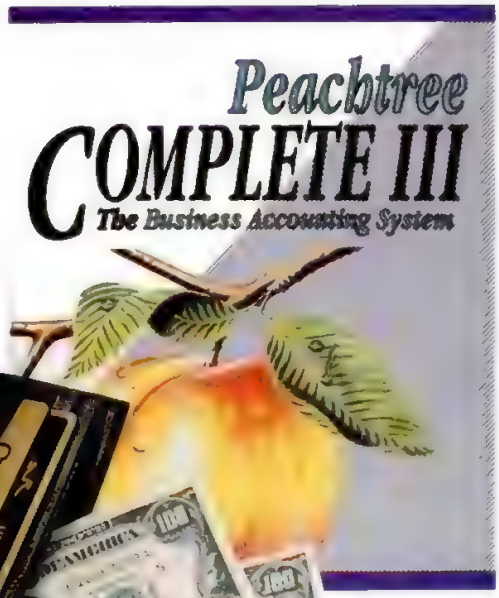

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In a computer program that plots the Mandelbrot set, every pixel in the display area is treated as a complex point P. The program performs the iterative calculation for every pixel. It colors the pixel black if it belongs to the Mandelbrot set and white if it does not. The image that results from this is shown in Figure 1.

All the images in this column were created using the PMMANDEL program running on an 8514/A video adapter. The program also runs on other video displays (such as the EGA and VGA) supported with Presentation Manager drivers, but I've used the 8514/A for the images shown here for maximum resolution and color capability.

> You might expect this image to be fairly simple, because the process used to create it is fairly simple. But the Mandelbrot set is very complex.

Below PMMANDEL's menu is a status line that indicates the current range of the real and imaginary coordinates, and the position of the mouse pointer within this coordinate space. The numeric range for the image in Figure 1 is real numbers from −2.25 to 1.75 and imaginary numbers from −1.5 to 1.5.

The program displays the full image when maximized. Otherwise, it displays only that part of the lower left of the image that can fit in the window.

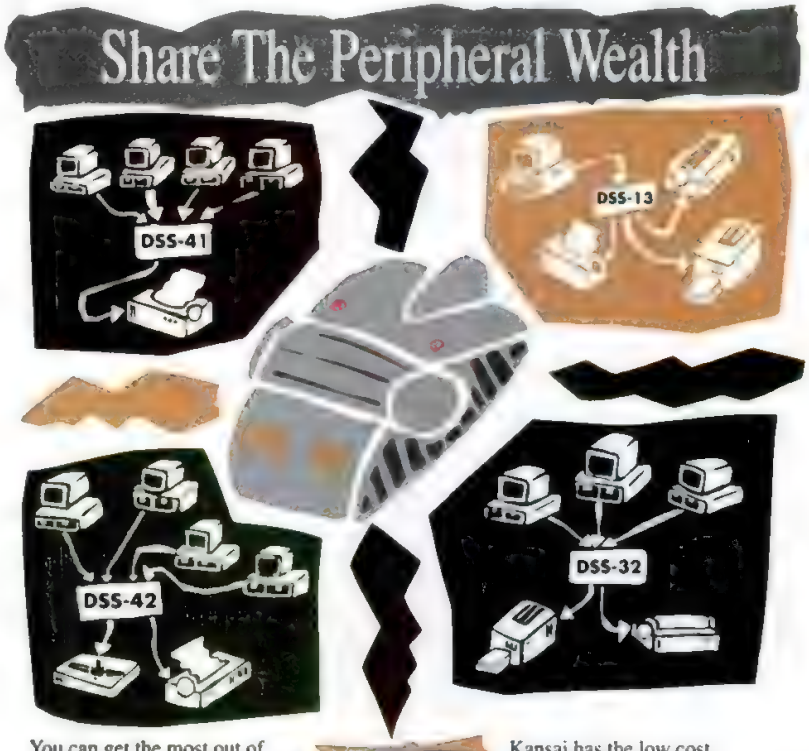
COMPLEXITY FROM SIMPLICITY

Although the process that creates the Mandelbrot set takes a little time to explain, it does not involve very complex formulas. You're just starting with a plane of complex numbers, taking each complex number, squaring it, adding the original number to the square, squaring that sum again, and so forth. The image is based on which complex numbers converge to infinity and which do not.

You might expect this image to be fairly simple, because the process to create it is fairly simple. But the Mandelbrot set is very complex. The area of the Mandelbrot set is bounded, yet the boundary is infinite in length. Notice the irregularities that appear around the surface of the image. You can zoom in on these irregularities and see as much detail as in the original image. No matter how far you zoom in, the boundary of the Mandelbrot set never becomes smooth.

ZOOMING IN

Using PMMANDEL, you can explore the boundary of the Mandelbrot set by block-



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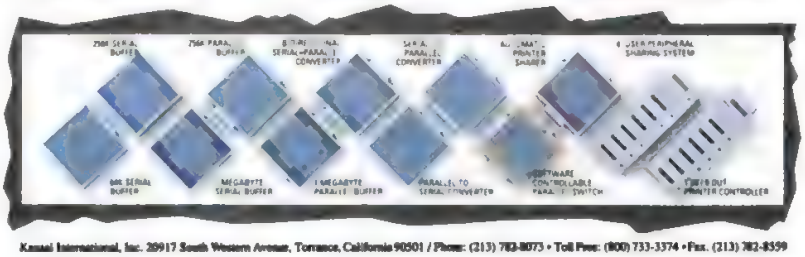

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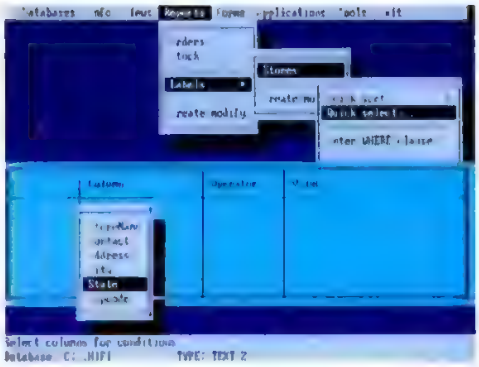

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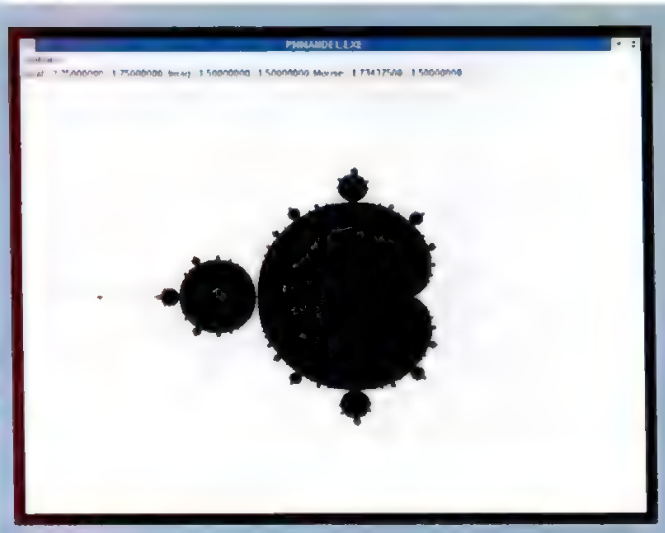

Figure 1: The basic Mandelbrot set as created with the PMMANDEL.EXE program. The black pixels belong to the Mandelbrot set, while the white ones do not.

Figure 2: The Mandelbrot set, using real coordinates from –0.34765625 to 0.10156250 and imaginary coordinates from 0.60857143 to 0.95142857. This is a detail of Figure 1.

ing out rectangular areas in the client window. PMMANDEL will then display the new image with the new coordinates.

To block out a rectangular area, you first position the mouse pointer at one corner of the rectangle and then double-click the left mouse button. As you move the mouse, you'll see a reverse-video block. Move the mouse to the opposite corner and press the left mouse button. To cancel this blocking-out operation while it is in progress, press any key. (Normally, a blocking-out operation is initiated by one mouse depression. However, I chose to use a double-click to avoid accidental block-outs.) Figure 2 shows a zoomed-in section of the top part of the image in Figure 1.

You can also enter the range of the real and imaginary coordinates in a dialog box that is invoked when you select the Coordinates option from PMMANDEL's Options menu.

ADDING COLOR

Now let's add some color to the Mandelbrot set. Let's take a look at the simplest approach, which is what PMMANDEL uses.

Suppose the video adapter is capable of 16 colors. Reserve black for points in the Mandelbrot set and use the other 15 colors for points outside the Mandelbrot set. You choose a color depending on how quickly z_n converges to infinity. If z_1 has a magnitude greater than or equal to 2, use color 1. Otherwise, calculate z_2. If z_2 has a magnitude greater than or equal to 2, use color 2, and so on. If z_{16} has a magnitude greater than or equal to 2, start again with color 1.

The Colors item from PMMANDEL's Options menu lets you select the number of colors (2, 16, or 256) that PMMANDEL will use. The 2-color option creates the uncolored Mandelbrot sets shown in Figures 1 and 2. The 256-color option is enabled only for video adapters, such as the 8514/A, that support 256 colors. The basic Mandelbrot set with color is shown in Figure 3.

As you zoom in on various areas of the Mandelbrot set near the boundary, an amazing world of strange and beautiful images emerges, with objects that look like spirals, amoebas, jewelry, and seahorses, often punctuated by miniature versions of the larger Mandelbrot set itself.

Figures 4 through 8 show a variety of examples. Figure 6 is a zoomed-in area of Figure 5, which itself is a zoomed-in area of Figure 4. Figure 8 is a zoomed-in area of Figure 7.

The best collection of high-resolution color Mandelbrot images I've seen is in the book, *The Beauty of Fractals*, by H. O. Peitgen and P.H. Richter (Springer-Ver-

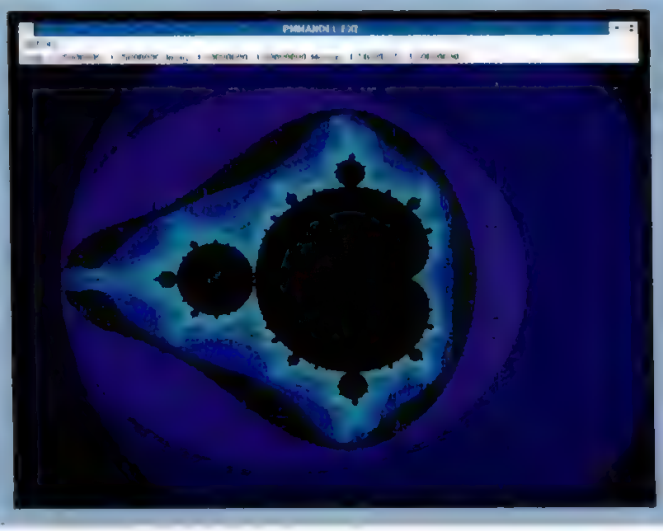

Figure 3: The basic Mandelbrot set with color on an 8514A adapter.

lag, 1986). A table on page 193 of this book lists the coordinates of the Mandelbrot images. You can type the coordinates into PMMANDEL and generate them yourself. (Indeed, Figures 4 and 5, shown here, are the same images in color plates 45 and 48 in the book.) Don't expect the colors to match, however. The Mandelbrot images in *The Beauty of Fractals* use very different color schemes.

HOW MANY ITERATIONS?

A Mandelbrot program determines whether a point does not belong to the Mandelbrot set if the iterative series converges to infinity. But how can you tell that z_n is not converging to infinity? How many iterations are enough?

> Zoom in on areas of the Mandelbrot set near the boundary and an amazing world of strange and beautiful images emerges.

It's a problem. The images shown in Figures 1 and 3 both use a maximum of 500 iterations before determining that z_n is not converging to infinity. All the others use 1,000 iterations. You can change this number in a dialog box invoked from the Iteration item on the Options menu.

In general, the more you zoom in, the more iterations you'll need. If you zoom in on an area and see a lot of black, you might want to try increasing the iterations to see if it disappears.

If you consider the number of pixels on the screen together with the iterative process required for each pixel, it's not surprising that explorations of fractals came of age only with the computer. Some of the images shown in this column require hours with PMMANDEL running on a 386 machine with a 387 math coprocessor. Fractals eat up CPU cycles as though they were potato chips.

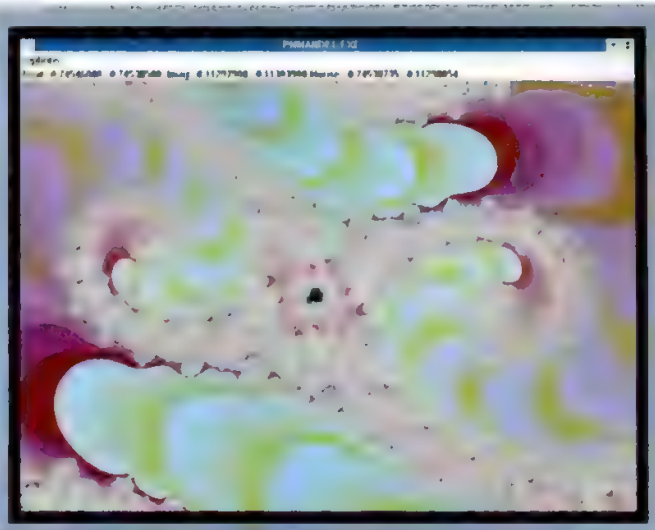

Figure 4: The Mandelbrot set, using real coordinates from –0.745468 to –0.745385 and imaginary coordinates from –0.112979 to –0.113039.

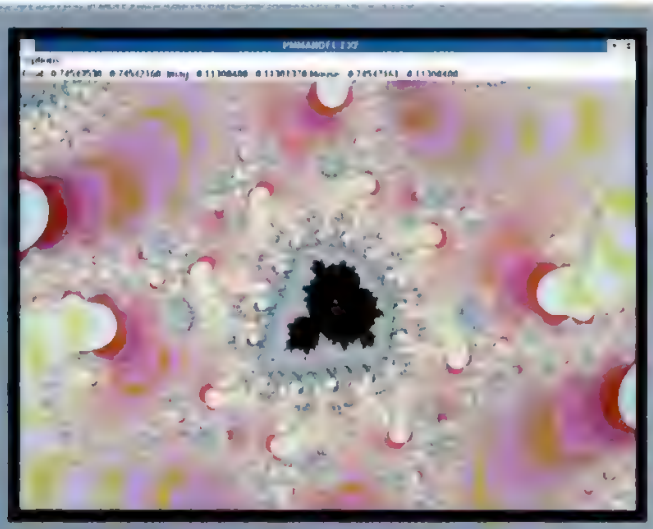

Figure 5: Zooming in on Figure 4 shows the Mandelbrot set with real coordinates from –0.7454353 to –0.7454216 and imaginary coordinates from –0.1130048 to –0.1130137.

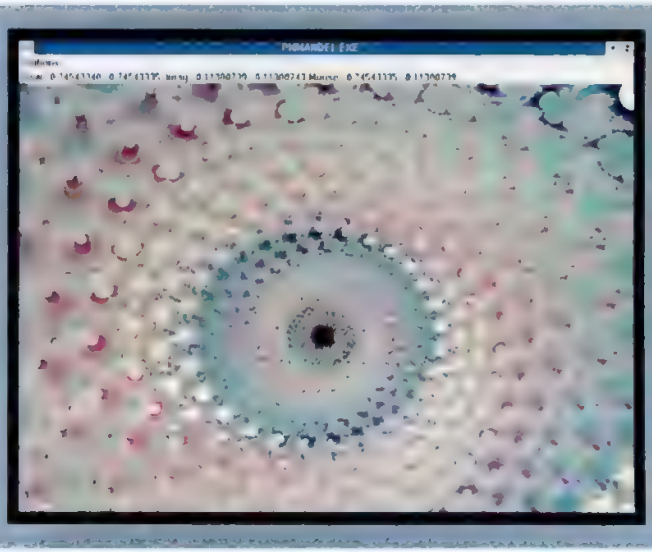

Figure 6: Zooming in, in turn, on Figure 5 displays the Mandelbrot set with real coordinates from –0.74543340 to –0.74543335 and imaginary coordinates from –0.11300739 to –0.11300743.

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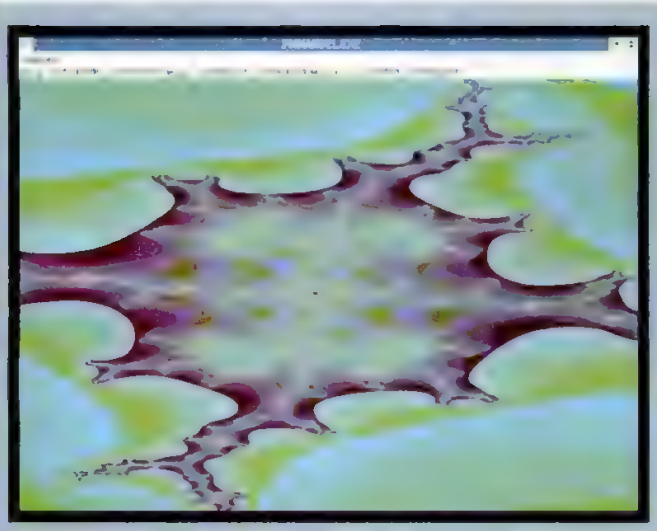

Figure 7: The Mandelbrot set with real coordinates from –0.15142590 to –0.15101939 and imaginary coordinates from 1.02788127 to 1.02864308.

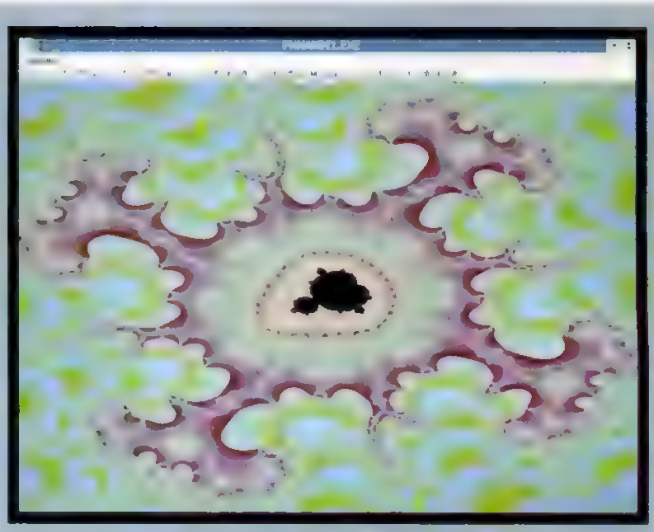

Figure 8: Zooming in on Figure 7 shows the Mandelbrot set with real coordinates from –0.15125163 to –0.15121353 and imaginary coordinates from 1.02824338 to 1.02828520.

PMMANDEL incorporates a feature that lets you see roughly what the image looks like before it is completed. The program begins by determining a color for each 64 by 64 block of pixels, then it gets more precise with 32 by 32 blocks, 16 by 16 blocks, and so forth down to one pixel.

If you get hooked on Mandelbrot images and don't want to wait, you should check out a DOS program called FRACTINT. The user interface is clunky, but the program is very fast. It is able to achieve high speed by using 32-bit integers interpreted as fixed-point numbers rather than floating-point numbers. This speeds up the calculations considerably. The FRACTINT program was created by a group of people who frequent the Computer Art forum on CompuServe. You can download the FRAINT.EXE executable and the FRASRC.EXE source code from the Fractals Data Library in the COMART forum on CompuServe. Both files are self-dearchiving. Charges for the connect time aside, the programs are free.

THE STRUCTURE OF PMMANDEL

If ever a program cried out for multitasking, a Mandelbrot program does. PMMANDEL uses multithread techniques discussed in earlier Environments columns.

THREADS1 (*PC Magazine*, May 29, 1990) drew on a bitmap in its second thread. When the bitmap was finished, the primary thread then drew this bitmap on the client window. Until the second thread finished drawing on the bitmap, the primary thread couldn't display the image.

This approach would work for the Mandelbrot program, but it wouldn't be entirely satisfactory. You would have to wait for the entire image to be drawn before you could see it.

> In a longer program like PMMANDEL, the performance benefits of creating and maintaining several threads of execution outweigh the overhead of the technique.

THREADS2 (in our June 12, 1990, issue) drew directly to the client window from its second thread. This also would work for the Mandelbrot program, but again, it would not be satisfactory. If part of the client window became invalid, the program would have to redraw the area.

What about combining the two methods? That's exactly the approach I took. The second thread draws on a bitmap the size of the client window when the program is maximized. When the second thread is finished with each row of pixels, it draws the row on the client window. You can see the image as it's being created, and the primary thread can update the client window from the bitmap whenever part of the client window becomes invalid.

Whenever the primary thread or the second thread needs to use the presentation space, the bitmap, or any shared variables, the thread enters a *critical section* with a call to DosEnterCritSec. This function suspends all other threads in the program. After the thread is finished with the shared resources, it calls DosExitCritSec to allow the other threads to run. No two threads in a program can be in a critical section at the same time.

In a small program, the overhead for creating and maintaining other threads of execution may seem inordinately high. But in a longer program like PMMANDEL, it's really not a big deal, and the performance benefits are considerable.

The source code for PMMANDEL is extensively commented, but if you have any questions about it, feel free to leave a message for me in the Programming forum of PC MagNet. ■

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by
William S. Hall

Windows

GETTING MORE OUT OF WINDOWS

This time we'll look at an information resource for *Microsoft Windows*, examine ways to get more colors from your EGA or VGA when running *Windows*, and explore WIN.INI, the *Windows* initialization file.

■ Find out how WIN.INI works, how to add more colors to Windows, and where to look for Windows' applications.

WIN.INI

In the *Microsoft Windows* directory, you'll find a text file called WIN.INI, the *Windows* initialization file, which both *Windows* itself and *Windows* applications can access. WIN.INI defines sets of values that the user wants *Windows* or programs to have at start-up time. Generally, it is not necessary to modify WIN.INI directly; usually, an application presents you with the necessary choices in a dialog box and it takes care of writing your selections to WIN.INI.

However, some fields can only be modified directly, and there are a number of undocumented fields that may need to be set for specialized needs. So, it can be helpful to understand the organization of WIN.INI and the meanings of the various sections. The quantity of information is vast, and we won't try to duplicate it here. But we will provide some general information as well as references to sources.

Since WIN.INI is a text (ASCII) file, it can be changed with an editor. If you're using a word processor, however, you must save the modified file in text form. The safest method is to use *Windows Notepad*. In fact, there is a field in WIN.INI that allows you to "run" it; that is, if you double-click on WIN.INI, *Notepad* will execute and load WIN.INI for you to edit. As usual, if you aren't sure what you're doing, back up the working copy first.

When *Windows* first runs, it searches for WIN.INI in its boot directory. If not found, a search is made along the DOS path, and the first WIN.INI found will be opened and loaded into memory where it resides. Hence, if changes are made to the file using a text editor from *Windows*, they will not take effect until *Windows* is run again. However, if changes occur because *Windows* itself makes the modifications (Control Panel, for example), then both the disk and memory image are updated, and the new information is immediately available. You can exploit this behavior to get *Windows* to reread a just-edited WIN.INI without restarting. Run the Control Panel and select Preferences and then Screen Colors. When the dialog box appears, just click OK. After you exit the Control Panel, WIN.INI will be up to date in memory as well.

WIN.INI consists of blocks in the form

```
[Section]
keyname1=val1
keyname2=val2
.
.
.
```

where Section can indicate a particular classification such as ports, colors, devices, and so on, or it can be the name of a *Windows* application such as *Windows Write*, *PageMaker*, or *Microsoft Excel*. A keyname is a particular item, and the right side of the equality states its value. Here, for example, is the entry for Palantir's *Windows Spell* program:

```
[Spell]
Document=WRITE
Main-Dict=F:\WIN286\SPELL.LEX
Extent=WINTX:WRI
HotKeys=CTRL-F9,CTRL-F10
Position=3,77,648,301
```

As you can see, a WIN.INI entry is fairly readable. That doesn't necessarily mean it makes a lot of sense—it's always wise to look at the relevant documentation if the meaning of a particular field isn't clear.

Comments can be placed in WIN.INI by using a semicolon. Here is an example for DC, a simple digital clock application first published in *Programmer's Journal* (Volume 6.4)

```
[DC]
; the following values determine
; the font size when the clock
; displays the time in its icon
; window.
fontheight=8 ;pixel height of font
fontwidth=6 ; pixel width of font
fontweight=700 ; weight of font
```

In some older versions of *Windows*, placing an = or bracketed text in a commented line could cause problems. Despite the semicolon, the line was often interpreted as a section name or as keyname=value. It's probably a good idea to avoid the use of =, [, or] in a comment.

Programmers access WIN.INI using function (API) calls that allow reading a value string or integer or writing a value string. After modifying WIN.INI, a well-written application will use the *Windows* message system to inform other applications that the file has changed.

Currently, the API calls are limited to reading and writing only WIN.INI itself. Consequently, some *Windows* applications create their own initialization files using unique formats that are otherwise indecipherable. It is my hope that future versions of *Windows* will allow application-specific .INI files.

As you use *Windows*, WIN.INI evolves from the initial form created at setup to reflect your current configuration. If you need to reinstall *Windows* into the same directory, the Setup program will copy the present version of WIN.INI to WIN.OLD. Afterward, you may want to merge the two files. Such a task is quite easy to do by running two instances of *Notepad*, one containing the new file and

the other the old. By copying and pasting from the old to the new version, you can complete the merge fairly painlessly.

Version 2.0 of the *Microsoft Windows User's Guide*, Appendix A, contains a 15-page section on the meanings of the various elements in WIN.INI that are applicable to *Windows* in general. If you have the *Windows* Software Development Kit (SDK), you can find additional information in Chapter 7, Section 7.4, of the *Programmer's Reference Manual*. Of particular interest here are the settings used to locate problems in the area of memory management. These have been supplemented in the SDK's Update Notes.

If you use *Windows/386*, there are some special settings that affect its operation. You can find an explanation of some of them beginning on page 25 of the *Using Microsoft Windows/386* manual. Others are explained in more detail in the README.TXT file. Finally, you should read through WIN.INI itself for additional information.

There are a number of keynames used mainly by *Windows/386* that are not explained in any of the currently supplied *Windows* documentation. Many of these cover special problems in using expanded memory and networks. These include fields such as `emmpageframe`, `lastemmseg`, `emminclude`, and `emmexclude`. In addition, some nonstandard hardware such as ESDI disk controllers and the Bernoulli Box require the use of the `virtualldirq` keyname to bypass *Windows/386*'s virtual machine handling of ROM routines.

One source of information regarding these special settings is Microsoft ONLINE. If you or your company have an account, you can search the Knowledge Base for particular items. Not long ago, I managed to find 56 items about *Windows/386* and WIN.INI alone. Especially useful is the downloadable text file SWITCHES .ARC, which covers all of the settings under [Win286] and [Win386]. You may find that many of your difficulties in using *Windows/386* will be reduced or eliminated by some careful study of these notes.

At any rate, we can always try to help you with specific questions. Don't be bashful; write and tell us what you want to know. For example, if after reading the explanations in the manuals, you are still confused by such things as

```
[colors]
ActiveBorder=127 127 127
```

(and, who wouldn't be without a course on color representation!) I will try to help. And, speaking of colors . . .

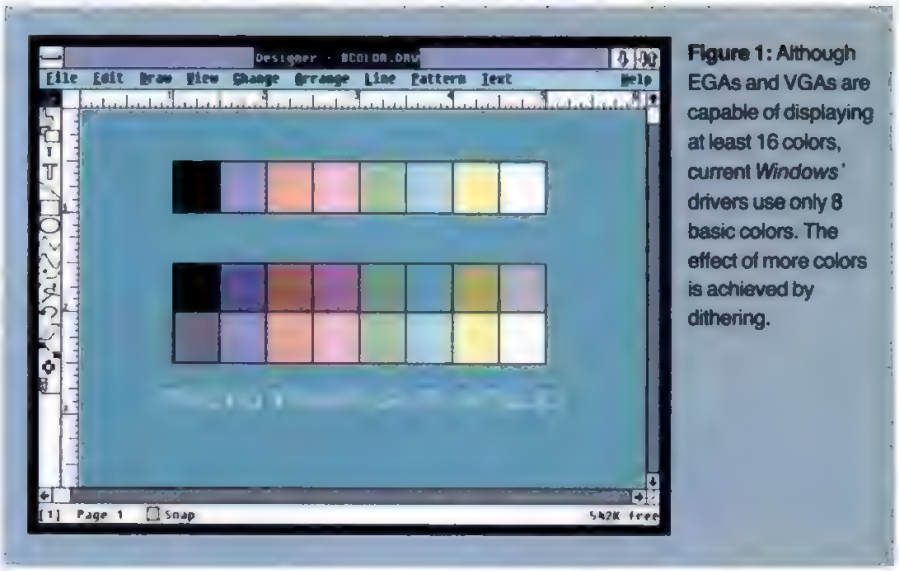

Figure 1: Although EGAs and VGAs are capable of displaying at least 16 colors, current *Windows'* drivers use only 8 basic colors. The effect of more colors is achieved by dithering.

16 COLORS

If you have an EGA or VGA in your *Windows* machine, you probably know that in high-resolution graphics mode, either display is capable of displaying 16 different colors from a selection (or palette) of 64. If you have a VGA, the palette can be much larger, because the output lines to the monitor can also be stepped over a range of intensity values instead of merely being on or off, as is the case for the EGA. However, you may not be aware that the standard EGA and VGA display drivers for both *Windows* 1.0 and 2.0 use only eight basic colors and have no provision for altering the palette.

By using a technique known as dithering, *Windows* can achieve the effect of many more colors. However, dithering is really an area effect; a pattern composed of dots of the basic colors is displayed to trick the eye into seeing a new color. Unfortunately, the extra colors are achieved only at a loss of resolution, and line objects seem to be less easily manipulated. Having more basic colors reduces the need for dithering. For example, the IBM 8514/A has enough colors so that dithering is not needed at all.

So, how can you increase the number of basic colors in *Windows* to match the capability of the device? Some manufacturers of video boards supply *Windows* drivers that offer increased resolution, greater color capability, or both. The Paradise Professional VGA, for instance, provides a single *Windows* driver that can operate in 2, 8, or 16 colors in both 640 by 480 and 800 by 600 resolutions. Video Seven has similar offerings. But what if you'd like more colors available without having to buy a new piece of hardware? You can use hDC Computer Corp.'s enhanced display driver, *Windows Color*, which doubles the number of colors available for EGA or VGA. Figure 1 shows the colors normally available with *Windows*, while Figure 2 displays the 16 colors available after *Windows Color* is installed.

hDC has been providing *Windows* products since 1986. We'll discuss two of the company's applications, *Windows Manager* and *Windows Express*, in a future column. Here we'll take a close look at *Windows Color*. This gives us an excuse to talk about pixels, pels, and palettes; a basic knowledge of these terms is becoming more important to understanding *Windows* as it evolves.

Windows Color is interesting for more than just its doubling of the number of colors available for EGA or VGA. In fact, hDC drivers can modify the palette selection as well. Certainly 16 colors can present a much nicer display in *Windows* than 8 colors, and you may even find the option of setting the palette useful.

Understanding *Windows Color* requires understanding how colors are displayed on the PC. Here's the idea: if each pixel element (pel) has *n* bits of information associated with it, then that pel is capable of displaying 2^n different colors, and

Figure 2: hDC's enhanced display driver, *Windows Color*, doubles the number of colors *Windows* can display.

these define the device's basic colors. An EGA or VGA in the modes used for *Windows* contains four memory planes with 1 bit per plane for each pel. Hence $n=4$, and $2^4 = 16$, so 16 colors are possible.

The lowly CGA, in its highest resolution graphics mode (640 by 200) has one pixel for each pel in one plane, so it has only two colors, usually black and white. By contrast, the 8514/A uses 8 bits per pel in one plane in its 1,024 by 768 mode and thus can show 256 colors. By trading resolution for pixels/pel, you gain more colors for a given amount of video memory. For example, the CGA can be set to use two pixels per pel to obtain four colors, but the graphics resolution drops to 320 by 200. However, *Windows* has traditionally favored high resolution over increased number of colors, and the more colorful modes are generally not supported.

Actually, using the term *colors* is a bit premature, because there are some additional factors that determine whether the pels are actually realized as color. One factor is the monitor, which must be capable of showing color and must have the required number of input lines using the required logic. Another is the color table in the display adapter. For now, let's confine our discussion to the EGA in its high-resolution color mode. The VGA works a bit differently, but in the mode used by *Windows*, the effect is the same.

An EGA adapter expects to work with a color monitor having six TTL (transistor-transistor logic) level video input lines. Such a monitor is therefore capable of displaying 2^6, or 64, different colors. The EGA has 16 settable palette registers, each capable of holding 6 bits of information. However, each pel contains only 4 bits. So, the value of each pel ranges from 0 to 15. If, say, a pel with bit pattern of 1001 (9) is being displayed, then the color that actually shows up on the screen will be determined by the number stored in the tenth palette register. In other words, the palette registers are simply a lookup table, and their contents completely determine the colors that will actually be seen.

Because the palette registers can hold 6 bits of information, up to 64 colors are at your disposal. But because a pixel element has only 4 bits, a maximum of 16 colors can be seen at any one time.

Each line on an EGA monitor is either on or off, while on an analog monitor, as used by the VGA, each line can have a range of values. The number of colors that can be realized is therefore much richer on a VGA, but its achievement requires more than just varying the palette registers.

By changing the palette registers several interesting effects can be achieved. hDC *Windows Color* includes a utility that can be used to manipulate these registers. How it works is rather interesting. Starting from a base where a given pel color passes through the palette registers unchanged, for each of the 16 colors, the user can adjust each of the three pairs of palette bits in a given palette register through its four possible values. The results are immediately visible, and you can watch the effect on your screen as you move the sliding controls throughout their ranges.

If you install the hDC driver, you may find that some less well written applications may be baffled by the increased capability. In fact, the *Windows* API (application programmer's interface) provides a number of functions for reading the device's capability and writing programs in a device-independent way. Nevertheless, some programs may make assumptions that prevent them from taking full advantage of the resources available.

Installation of the hDC driver requires setting up *Windows* again. In fact, you must make a so-called hardware installation, and hDC does supply complete instructions on how to do this. Drivers are supplied for both *Windows/286* and *Windows/386*, and you can even choose between 450-line and 480-line drivers for the 386 version. (I bet you didn't know that *Windows/386* doesn't use the full 480 lines of the VGA. But before you write any irate letters to Microsoft, ask me first and I'll try to justify that design choice.) Since the new installation may be made in your existing setup, you're also told how to save certain critical files, such as modified PIFs and WIN.INI. We would like to add another way to make a new *Windows* installation while keeping the old one. What follows applies generally to *Windows/286* and to a limited extent to *Windows/386*.

In *Windows/286*, the hardware dependencies are contained in three files, WIN200.BIN, WIN200.OVL, and WINOLDAP.GRB. If you'd like to have both standard and hDC versions of *Windows* on your VGA system, without duplicate installations, here's what you can do:

First, go through a normal setup using the *Windows* distribution disks. (If *Windows* is already installed, skip this step.) When done, make two subdirectories, one called VGA and the other HDC, in your *Windows* directory. Copy the three files mentioned above into the VGA directory. Now install *Windows* again, this time with the hDC driver, into a temporary directory. When done, copy the newly created WIN200.BIN, WIN200.OVL, and WINOLDAP.GRB file to the HDC subdirectory in your *Windows* directory, delete all files in the temporary directory, and remove it.

Now, whenever you want to switch from, say, standard VGA to the hDC installation, just copy the contents of the HDC directory to *Windows* and run *Windows* again. You can always restore the old system by copying the files from the VGA directory.

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several different hardware installations. I've used it to switch between two keyboards or different display resolutions. Of course, it's not efficient if you need many different hardware configurations, and it is more convenient to use the so-called slow boot version of *Windows*, which I'll describe in a future column. Also, if you switch among displays of different resolutions, you may have to add more fonts.

In the *Windows/386* environment, you need to make sure you have the correct versions of WIN386.386 and WIN386.EXE. However, for VGA and EGA installations, these files are the same. It is one of the real shortcomings of *Windows* that you can't switch hardware without some form of reinstallation. We hope future versions will be more versatile.

THE WINDOWS SHOPPER'S GUIDE

"The problem with *Windows* is that there is no software." How many times have you heard this lament by even those who like and use *Windows* regularly? Well, the truth of the matter today is quite the opposite! Unfortunately, however, it hasn't always been easy to find the programs. Until early this year, the only source of information about *Windows* products has been a somewhat utilitarian catalog printed by the Waggener Group. But this has all changed with the appearance of the very attractive *Windows Shopper's Guide* from Whitefox Communications.

The first edition, which appeared during the last half of 1989, is 3/8 of an inch thick and contains 224 glossy pages on heavy stock. Products are grouped into 22 categories. Forthcoming products are described, too, and there is a directory of consultants. Extensive indexes complete the catalog.

Whitefox Communications itself is a fairly new firm, but the database that was used as a basis has been growing since *Windows*' early days. The founders, Mike Jones and John Schmitt, came from Intel, and both have been *Windows* enthusiasts since its beginning. Between them, they had accumulated over 20 years of experience in the computer industry before striking out on their own in 1989. Needless to say, they are quite pleased with the initial success of the *Shopper's Guide*. Plans call for its distribution via many channels, including software stores, technical and popular bookstores, and libraries. Distribution in Europe is also very important, since that continent currently holds about 60 percent of the *Windows* market.

The *Shopper's Guide* is an invaluable source for consultants, PC managers, VARs (value-added resellers), and anyone looking for information on the approximately 500 *Windows* products available today. Copies are available for $17.95 from Whitefox Communications Inc., P.O. Box 7125, Beaverton, OR 97005-7125. Yearly subscriptions (three issues) are priced at $39.95 (you must add postage, which in the U.S. is $3.50 per catalog).

OPENING WINDOWS

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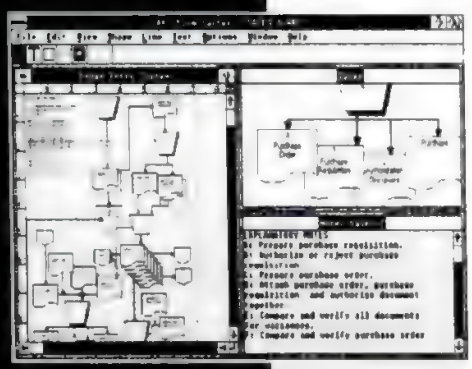

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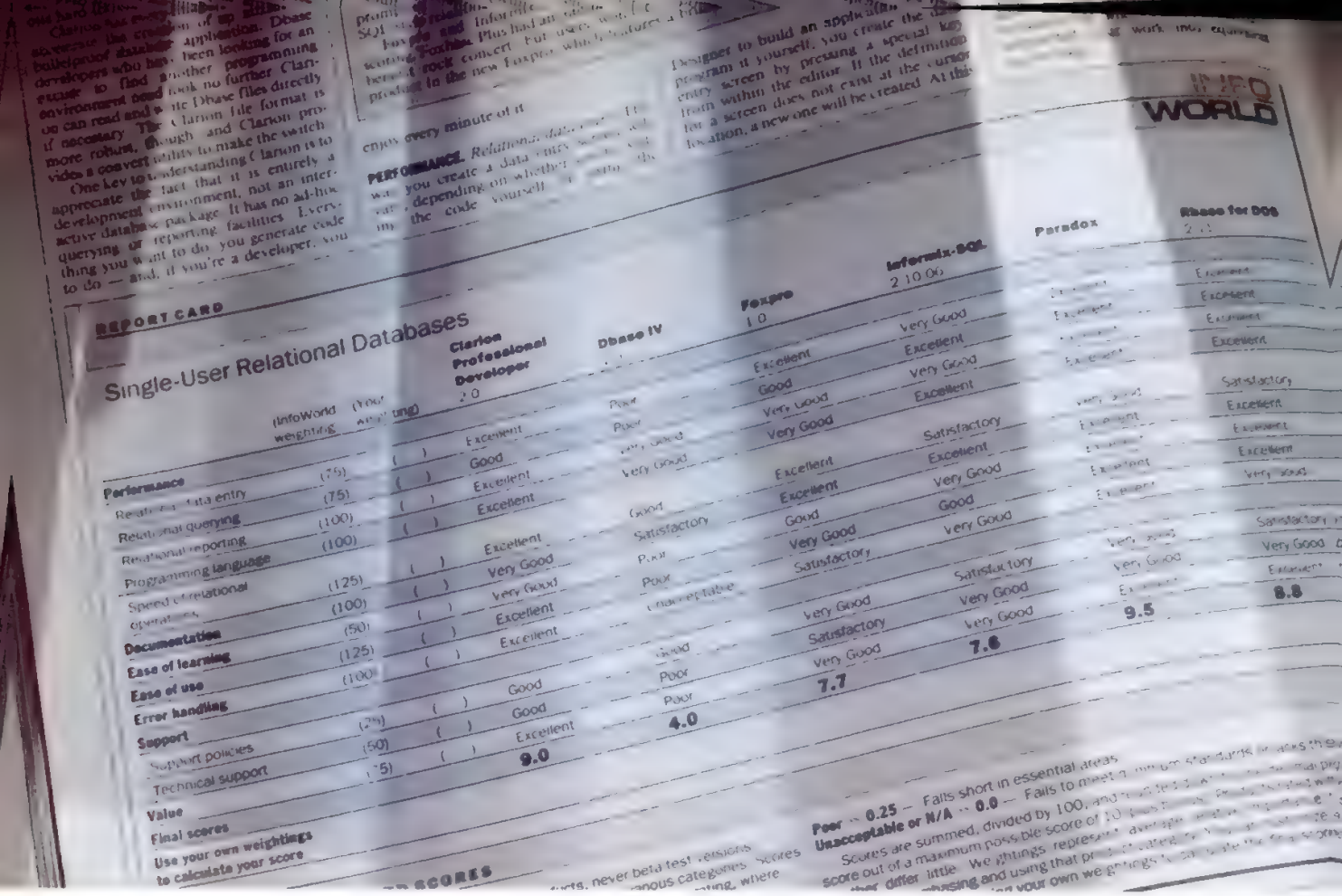

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edited by
Trudy Neuhaus

Databases

FOXPRO FUNCTIONALITY

Fox Software's *FoxPro* brings to database programming a number of new features and capabilities. Among these, its event-driven user interface, mouse support, and debugging and compiling facilities stand out. It would be pretty hard to migrate from the dot prompt to *FoxPro*'s interactive environment and not experience some kind of productivity boost. In this column, we'll explore how you can manipulate these features to build similar functionality into your database applications.

FOXPRO AND WINDOWING

FoxPro's user interface is notable for its scrollable windows, mouse support, drop-down menus, and dialog boxes. Its design emulates some of the better features of products such as *Microsoft Windows*, OS/2's Presentation Manager and *FoxBASE+/Mac*—Fox Software's own already successful product.

Generally, windows are used to confine program output to a specified area on the screen. When a window is active, all output is directed to that window and all positioning is relative to the upper-left corner of that window (the first available position being 0,0). If you remove the window, the screen below it is automatically restored. To create a plain-vanilla window with a title using the DEFINE WINDOW command, you might use *FoxPro*'s color and border defaults:

```
DEFINE WINDOW win1 FROM 3,5 TO
 14,75 TITLE 'win1'
```

The command above allocates memory for the window and defines it internally to *FoxPro*. However, this command does not automatically display the window. To activate the window and display it on-screen requires

```
ACTIVATE WINDOW win1
```

Now, any direct screen output will appear in win1. To remove the window from the display and memory and to direct the screen to its original destination, use the following commands:

> ■ Combining timesaving debug and compiling capabilities with the finer features of graphical interfaces, FoxPro offers a state-of-the-art platform for database developers.

```
DEACTIVATE WINDOW win1
     && Remove from screen
        and deactivate
RELEASE WINDOWS win1
     && Remove from memory
```

FoxPro's interactive nature and support of the mouse lend themselves to manipulating windows. There are a number of options available that let you define the placement, appearance, and operation of a window. The instructions

```
DEFINE WINDOW win1 FROM 5,10;
 TO 14,70 SYSTEM CLOSE GROW;
 ZOOM FLOAT SHADOW TITLE 'A;
 Mousier Win1' COLOR SCHEME 8
ACTIVATE WINDOW win1
```

set up a new win1 using some of the mouse control options.

The SYSTEM option displays a panel border around the window and displays the available mouse controls. You can also choose DOUBLE borders or NONE (to suppress the border entirely should you wish to do so). Alternatively, you can define your own. And if you don't specify a border option at all, the window defaults to a single line border.

The CLOSE option displays the CLOSE control in the upper-left corner of the window; clicking on this control with a mouse deactivates the window and removes it from memory. The GROW control, in the lower-right corner, lets you interactively resize the windows by clicking and dragging the mouse. ZOOM displays the ZOOM control in the upper-right-hand corner; click on this control to toggle the window from its current dimensions to full screen and back again.

FLOAT lets you click on the upper border and drag the window to another position on the screen—or even off screen if you like. SHADOW displays a shadow behind the window. Use TITLE to specify the window title and COLOR SCHEME *nn* to specify colors.

Is it worth building mouse support into your applications? You bet. Although *FoxPro* is entirely accessible via your keyboard, the point-and-click mouse interface is often faster and more intuitive than trying to remember keystroke combinations, especially when you're working with windows. And whereas other desktop environments are often graphically-based, *FoxPro* is character based. So it can move, stretch, and zoom most visual display elements as fast as you can move your mouse. There isn't a quicker way to navigate this environment.

Continuing with our illustration, let's suppose you want to hide the window without deactivating it; you would simply use the command

```
HIDE WINDOW win1
```

Although this command removes win1 from the display, the window remains active and continues to receive all output—it just isn't visible. To reverse the condition and redisplay win1, use the SHOW WINDOW command.

SHOW WINDOW can also be used to display an inactive window. However, in this case, the window displayed will not be active; that is, it will not receive output. If you wish to direct output to a window, you must first ACTIVATE it.

Using the IN WINDOW <window name> clause, you can confine the visual display of BROWSE, EDIT, CHANGE,

and MODIFY COMMAND to certain windows. So, for example, you can specify that a BROWSE take place in a specific window. Furthermore, you can use the IN WINDOW clause of the DEFINE WINDOW command to confine a new window within the borders of an existing window as well. This option lets you, for example, create windows that can be moved only within the borders of an already existing window.

Finally, to move a particular window to new screen coordinates, you would use the MOVE WINDOW command. This command supports relative coordinates, as shown in the instructions

```
MOVE WINDOW BY 1,1
     && Move window by +1
        row and +1 column
```

as well as fixed coordinates.

USER-DEFINED MENUS

FoxPro lets you create several types of menus, including the familiar drop-downs and pop-ups, which use bounce bars and support the mouse. To illustrate how this works, we'll create a drop-down menu system that includes a menu bar with the System, File, and Edit menu pads just like *FoxPro*'s. The System and File pads will trigger drop-down (or pop-up) menus. And when you make a choice, a window will appear, verifying your selection.

Although *FoxPro* also supports several other methods that will be familiar to users of *FoxBASE+* and *Clipper*, ACTMENU .PRG in Figure 1 uses the DEFINE/ACTIVATE MENU commands. These are supersets of the same commands implemented in Ashton-Tate's *dBASE IV*. When run, ACTMENU will create the window shown in Figure 2.

Several things are noteworthy here. DEFINE MENU creates a named menu. You attach pads to the menu using DEFINE PAD. Each pad has an associated prompt, and you can position the pads anywhere you want.

The coordinates in DEFINE MENU are subject to the currently active window, in this case win1. If we had not activated any

ACTMENU.PRG — COMPLETE LISTING

```
*****************************************************************
* ACTMENU.PRG - Demonstrate FoxPro ACTIVATE MENU
*****************************************************************
CLEAR
SET BORDER TO SINGLE          && Single line border
*
* Confine to our window
*
DEFINE WINDOW win1 FROM 2,5 TO 23,74 TITLE "ACTMENU.PRG"
ACTIVATE WINDOW win1
*
* First define the actionbar
*
DEFINE MENU foxmenu
DEFINE PAD systemp  OF foxmenu PROMPT '\<System'    AT 00,00
DEFINE PAD filep    OF foxmenu PROMPT '\<File'      AT 00,00
DEFINE PAD editp    OF foxmenu PROMPT '\<Edit'      AT 00,14

ON PAD systemp OF foxmenu  ACTIVATE POPUP syspop
ON PAD filep   OF foxmenu  ACTIVATE POPUP filepop

ON SELECTION PAD editp OF foxmenu DO msgwin WITH "You chose PAD ";
   +PAD()+" of the "+MENU()+" menu",;
   "Menu pad "+'"'+ALLTRIM(PROMPT())+'"'+" is not implemented"
*
* Now define the drop-down menus
*
DEFINE POPUP syspop FROM 01,00 SHADOW
DEFINE BAR  1 OF syspop    PROMPT ' \<About FoxPro...'
DEFINE BAR  2 OF syspop    PROMPT ' \<Help...          F1'
DEFINE BAR  3 OF syspop    PROMPT ' \<Macros...'
DEFINE BAR  4 OF syspop    PROMPT '\-'     SKIP
DEFINE BAR  5 OF syspop    PROMPT ' \<Filer'
DEFINE BAR  6 OF syspop    PROMPT ' \<Calculator'
DEFINE BAR  7 OF syspop    PROMPT ' Calendar/\<Diary'
DEFINE BAR  8 OF syspop    PROMPT ' \<Special Characters '
DEFINE BAR  9 OF syspop    PROMPT ' ASC\<II Chart'
DEFINE BAR 10 OF syspop    PROMPT ' Ca\<pture'
DEFINE BAR 11 OF syspop    PROMPT ' Pu\<zzle'

DEFINE POPUP filepop FROM 01,08 SHADOW
DEFINE BAR  1 OF filepop   PROMPT ' \<New...'
DEFINE BAR  2 OF filepop   PROMPT ' \<Open...'
DEFINE BAR  3 OF filepop   PROMPT ' \<Close'
DEFINE BAR  4 OF filepop   PROMPT '\-'  SKIP
DEFINE BAR  5 OF filepop   PROMPT '\ \<Save'            && Unselectable
DEFINE BAR  6 OF filepop   PROMPT '\ Sa\<ve As...'
DEFINE BAR  7 OF filepop   PROMPT '\ \<Revert'
DEFINE BAR  8 OF filepop   PROMPT '\-' SKIP
DEFINE BAR  9 OF filepop   PROMPT ' Pr\<inter Setup...'
DEFINE BAR 10 OF filepop   PROMPT ' \<Print...'
DEFINE BAR 11 OF filepop   PROMPT '\-' SKIP
DEFINE BAR 12 OF filepop   PROMPT ' \<Quit'

ON SELECTION POPUP syspop  DO sysproc
ON SELECTION POPUP filepop DO fileproc

DO WHILE .T.
   ACTIVATE MENU foxmenu   && Stays active until DEACTIVATE MENU command
                           && or ESC pressed (which deactivates it)
   IF (MENU()=="")         && If menu has been deactivated
      EXIT                 && Leave the loop
   ENDIF
ENDDO .T.
RELEASE MENU foxmenu       && Remove menu from memory
RELEASE POPUPS ALL         && Remove popups from memory
RELEASE WINDOW win1
RETURN

*****************************************************************
* PROCEDURE Sysproc handles options chosen from the System menu
*****************************************************************
PROCEDURE sysproc          && Handle System menu options
* HIDE POPUP Syspop
DO msgwin WITH "You chose BAR ";
   +ALLTRIM(STR(BAR()))+" of the "+POPUP()+" popup",;
   "Option "+'"'+ALLTRIM(PROMPT())+'"'+" is not implemented"
DO CASE
CASE BAR() = 1                                  && About FoxPro...
   * Do something
CASE BAR() = 2                                  && Help...
   * Do something
CASE BAR() = 3                                  && Macros...
   * Do something
CASE BAR() = 4                                  && -----------
   * Do something
CASE BAR() = 5                                  && Filer
   * Do something
CASE BAR() = 6                                  && Calculator
   * Do something
CASE BAR() = 7                                  && Calendar/Diary
   * Do something
CASE BAR() = 8                                  && Special Characters
   * Do something
CASE BAR() = 9                                  && ASCII Chart
   * Do something
CASE BAR() = 10                                 && Capture
   * Do something
CASE BAR() = 11                                 && Puzzle
   * Do something
ENDCASE
RETURN

*****************************************************************
* PROCEDURE Fileproc handles options chosen from the File menu
*****************************************************************
PROCEDURE fileproc         && Handle File menu options
* HIDE POPUP Filepop
DO msgwin WITH "You chose BAR ";
   +ALLTRIM(STR(BAR()))+" of the "+POPUP()+" popup",;
   "Option "+'"'+ALLTRIM(PROMPT())+'"'+" is not implemented"
DO CASE
CASE BAR() = 1                                  && New...
   * Do something
CASE BAR() = 2                                  && Open...
   * Do something
CASE BAR() = 3                                  && Close
   * Do something
CASE BAR() = 4                                  && ---------
   * Do something
CASE BAR() = 5                                  && Save'
   * Do something
CASE BAR() = 6                                  && Save As...
   * Do something
CASE BAR() = 7                                  && Revert'
   * Do something
CASE BAR() = 8                                  && ---------
   * Do something
CASE BAR() = 9                                  && Printer Setup...
   * Do something
CASE BAR() = 10                                 && Print...
   * Do something
CASE BAR() = 11                                 && --------
   * Do something
CASE BAR() = 12                                 && Quit'
   DEACTIVATE MENU                              && Finished...
ENDCASE
RETURN

*****************************************************************
* PROCEDURE msgwin Displays some messages in a window and waits for
*            a keypress
*****************************************************************
PROCEDURE msgwin           && Display window to user
PARAMETER TEXT, text1
DEFINE WINDOW msgwin FROM 15,20 TO 21,71 TITLE '&text1' SHADOW
ACTIVATE WINDOW msgwin
@ 1, (50 - LEN(TEXT))/2 SAY TEXT
@ 2, (50 - LEN(text1))/2 SAY text1
@ 4, 7 SAY 'Press any key or click on the mouse'
=INKEY(0,'HM')             && wait for keypress or mouse click
RELEASE WINDOW msgwin
RETURN

* EOF
```

Figure 1: Using the DEFINE/ACTIVATE MENU commands, this program will create the *FoxPro*-style drop-down menu system shown in Figure 2.

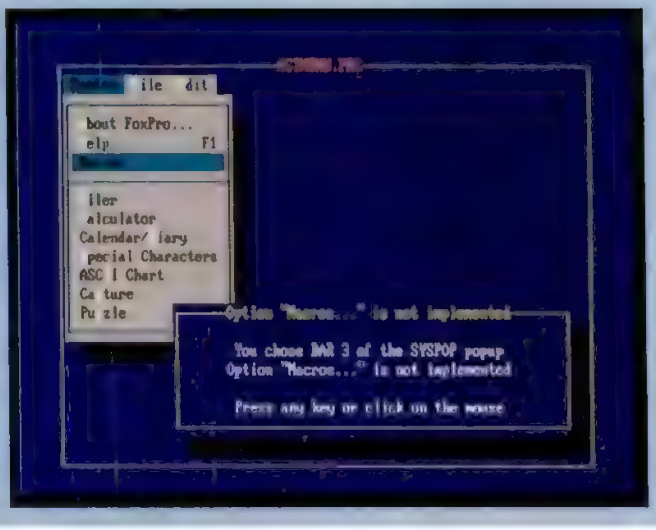


Figure 2: This menu includes a menu bar with System, File, and Edit menu pads that will trigger drop-down (or pop-up) menus. When you make a choice, a window will appear, verifying your selection.

windows, the menu would have been defined on the screen (the background, or desktop).

The first pad of the menu appears in the upper-left corner of the window at row and column coordinates of 0,0. Since you can define the coordinates for each pad, menus defined with DEFINE MENU are not restricted to being horizontal.

To define what happens when a user selects a menu pad, you use ON PAD or ON SELECTION PAD. The former is strictly for use with pop-ups and lets you attach a pop-up to the menu pad. The latter lets you execute any command when the pad is selected.

To activate a menu once it has been defined, use ACTIVATE MENU. The menus will appear, and the associated actions will be performed until a DEACTIVATE MENU command is issued or the user presses ESC to get out of the menu system.

Several built-in functions are provided to aid in using user-defined menus. For example, BAR() can be used to determine which bar was selected from a pull-down menu. Similarly, PAD() can be used to determine the pad selected. Some of these are illustrated in the example program.

SIMPLE DIALOG BOXES

You can use your knowledge of windows and menus to create simple dialog boxes similar to those used in programs such as Microsoft's Quick C or *Microsoft Works*. YESNO.PRG, in Figure 3, is a program that creates the dialog box shown in Figure 4. This dialog box prompts the user for a Yes, No, or Cancel reply. So that you can easily incorporate this into your programs, it's designed as a user-defined function (UDF). You can pass this UDF two messages for display, a title for the window to which the dialog will be directed, and a color scheme for the dialog display. It also centers messages in the window and assumes an 80 by 25 display. To use it in your program, you would code

```
answer = YesNo;
 ("Are You Sure You Want To",;
  "Delete the Master File",;
  "ALERT", 4)
```

You can take this one step further and make the dialog display-size aware. To do this, here's a hint: *FoxPro* provides built-in functions that provide screen or active-window dimensions.

DEBUGGING AND COMPILING

Perhaps the biggest timesaver for developers is *FoxPro*'s debugging facilities. The Trace window lets you visually monitor a program's execution line by line, highlighting each line as it executes. If the program scrolls by too fast, you can slow it down. With SET STEP ON, the program will execute one line per mouse click in the Trace window. You can set a breakpoint by pointing to the line where you want to break in the trace window and clicking the mouse on that line.

You can also monitor expressions and variables in the Debug window, which is then kept current as the program executes. If you want to break when an expression in the Debug window changes value, just point and click in the Debug window (breakpoints toggle on and off). When a program hits a breakpoint during execution, you gain full access to the environment. This means you can click on the Command window and interactively examine or modify memory variables and enter commands. And all the while, the Debug window is kept up to date. *FoxPro* lets you set an unlimited number of program breakpoints.

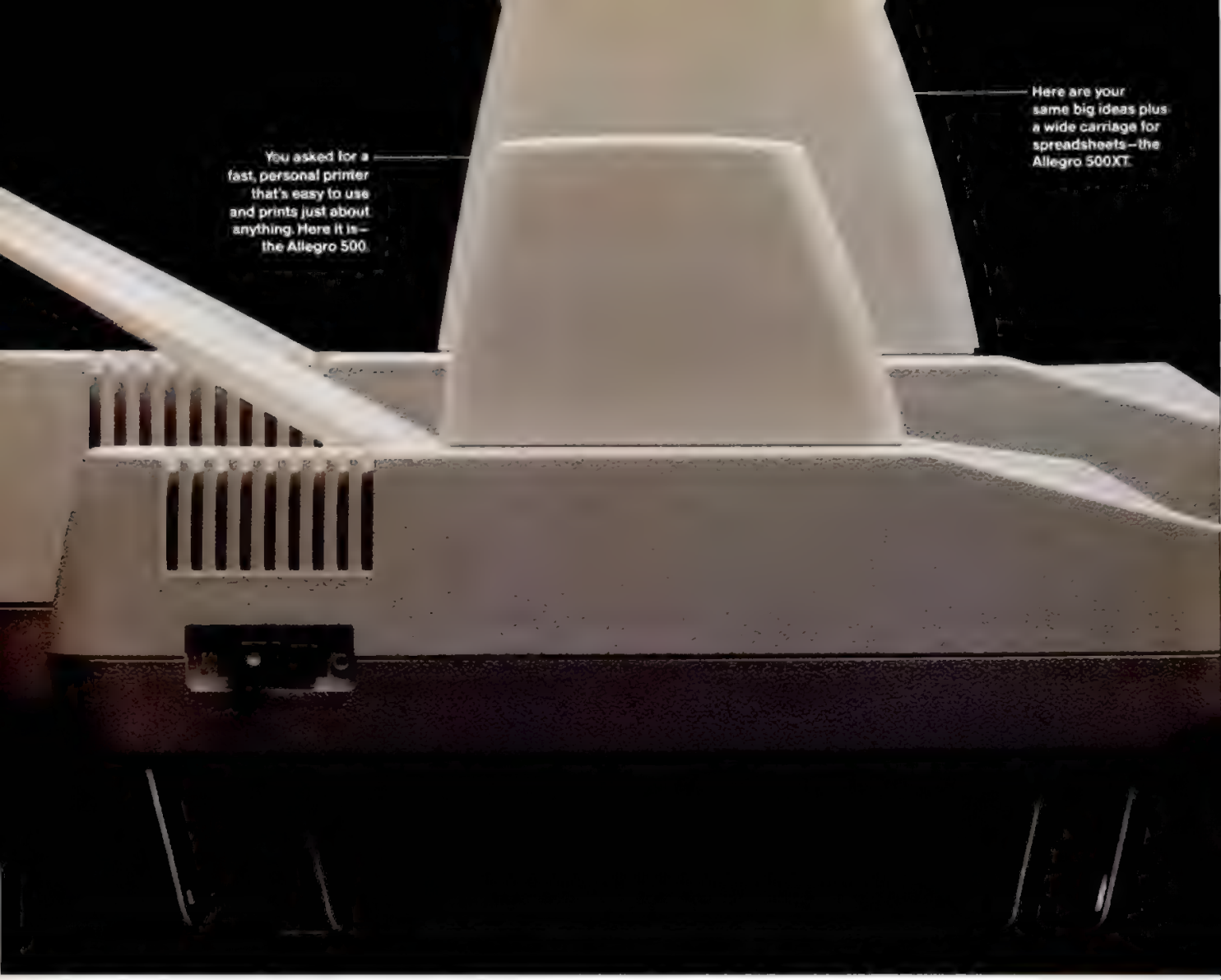
FoxPro's View window can be handy during development, since it tracks which databases are in use in each of *FoxPro*'s 25 work areas. A glance at the View window

YESNO.PRG — **COMPLETE LISTING**

```
*************************************************************************
* FUNCTION YesNo(msg1, msg2, title, colscheme)
*
* Display a Yes/No/Cancel dialog and return a response.
*
* Usage:
*     msg1 = "Are you sure you want to"
*     msg2 = "exit this application?"
*     title = " ALERT "
*     colscheme = 8
*     answer = YesNo(msg1, msg2, title, colscheme)
*
*************************************************************************
FUNCTION YesNo
PARAMETERS text1, text2, title, colscheme

DEFINE WINDOW yesno FROM 7, 15 TO 15, 65 TITLE "&title" COLOR SCHEME colscheme
ACTIVATE WINDOW yesno
@ 1, (50-len(text1))/2 SAY text1        && Display first message
@ 2, (50-len(text2))/2 SAY text2        && Display second message
```

```
DEFINE MENU yesno COLOR SCHEME colscheme
DEFINE PAD yes          OF yesno PROMPT '<    <Yes    >'  AT 04,03
DEFINE PAD no           OF yesno PROMPT '<    <No     >'  AT 04,17
DEFINE PAD cancel       OF yesno PROMPT '<    <Cancel >'  AT 04,31
ON SELECTION PAD yes    OF yesno DEACTIVATE MENU yesno
ON SELECTION PAD no     OF yesno DEACTIVATE MENU yesno
ON SELECTION PAD cancel OF yesno DEACTIVATE MENU yesno

ACTIVATE MENU yesno PAD no              && Get Yes, No or Cancel
DO CASE
CASE PAD()=="YES"                       && Set retcode
     STORE T. TO retcode
OTHERWISE
     STORE F. TO retcode
ENDCASE

RELEASE MENU yesno
RELEASE WINDOW yesno
RETURN retcode
* EOF
```

Figure 3: This program creates the dialog box shown in Figure 4. It's designed as a UDF, so you can easily incorporate it into your applications.



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is all you'll need to see which databases are open. You can also see a visual representation of any relations set from this window.

This debugging environment is a big improvement over the time-honored techniques of embedding display commands and SUSPEND statements within your code or using SET ESCAPE ON and then trying to hit Esc at just the right time.

But *FoxPro* doesn't stop here. It further enhances the debugging process by supporting whatever extended video modes your hardware environment can support, such as 43 lines on an EGA or 50 lines on a VGA. Thus you can keep more on the screen without having to overlap windows; you can open, close, and move the View, Debug, Trace, and Help windows at will and still maintain an 80 by 25 area for the application you're debugging. Depending on your hardware, an even larger area—up to 132 by 60—may be possible if you use a video-enhancement product such as Personics' *UltraVision*. To give you an idea of the possibilities, Figure 5 displays the Trace, Debug, and View windows during a live debugging session using *FoxPro* in combination with *UltraVision*, a VGA, and a good multisynchronous monitor. The display is in 120 by 50 mode.

FoxPro has several useful compiling features. First, you can compile *FoxPro* programs from within the environment using either the menu system or the compile command, which also accepts wildcards (COMPILE *.PRG, for example).

Secondly, you can tell *FoxPro* to automatically recompile a source file. When you execute a *FoxPro* program by typing DO *programname* in the Command window or by typing FoxPro *programname* from the DOS command line, *FoxPro* looks for a program with the same name and the .FXP extension. But suppose you have just edited the source file and, because you have forgotten to recompile it, an old version of the .FXP exists. What happens if you DO the program?

Using SET DEVELOPMENT ON, you can tell *FoxPro* to automatically recompile a source file if the corresponding .FXP is older than the source. Now you're protected from having to remember to manually recompile every time you change a source file. *FoxPro* also lets you encrypt these .FXP files to prevent someone from recovering your source.

Another feature, added in 1.01, lets you compile a file without the debugging information normally stored in the final .FXP file. This can save 8 bytes per source line and result in smaller compiled files. (Note: *FoxPro* compiles source files into a pseudocompiled format.)

In this issue I've examined how *FoxPro* lets you build modern applications with point-and-click interfaces and how its debugging and compiling facilities will save you time. But I've just scratched *FoxPro*'s surface here, so you can be sure I'll continue exploring this program's capabilities in future columns.

Figure 5: *FoxPro* enhances debugging by supporting whatever extended video modes your hardware environment can support. This photo shows the Trace, Debug, and View windows during a live debugging session using *FoxPro* and *UltraVision*, a VGA, and a good multisynchronous monitor. The display is in 120 by 50 mode.

Figure 4: This dialog box prompts the user for a Yes, No, or Cancel response.

LET US HEAR FROM YOU

Share your database experience, tips, techniques—even your UDFs—and we'll pay you $50 for any submissions we print. Submissions must be made on-disk, and be sure to include a printout. Mail your contributions to Databases, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column for instructions.) ■

Research for this article was provided by Salvatore P. Ricciardi, a New York-based consultant and frequent contributor to PC Magazine.

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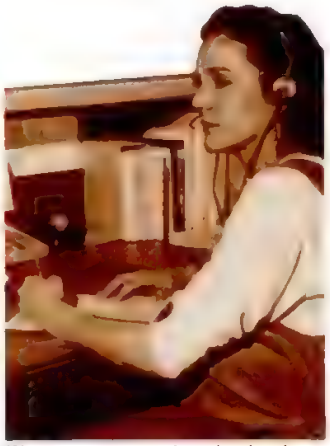

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*Jerry Pournelle holds a doctorate in psychology and is a writer who also earns a comfortable living writing about computers present and future.
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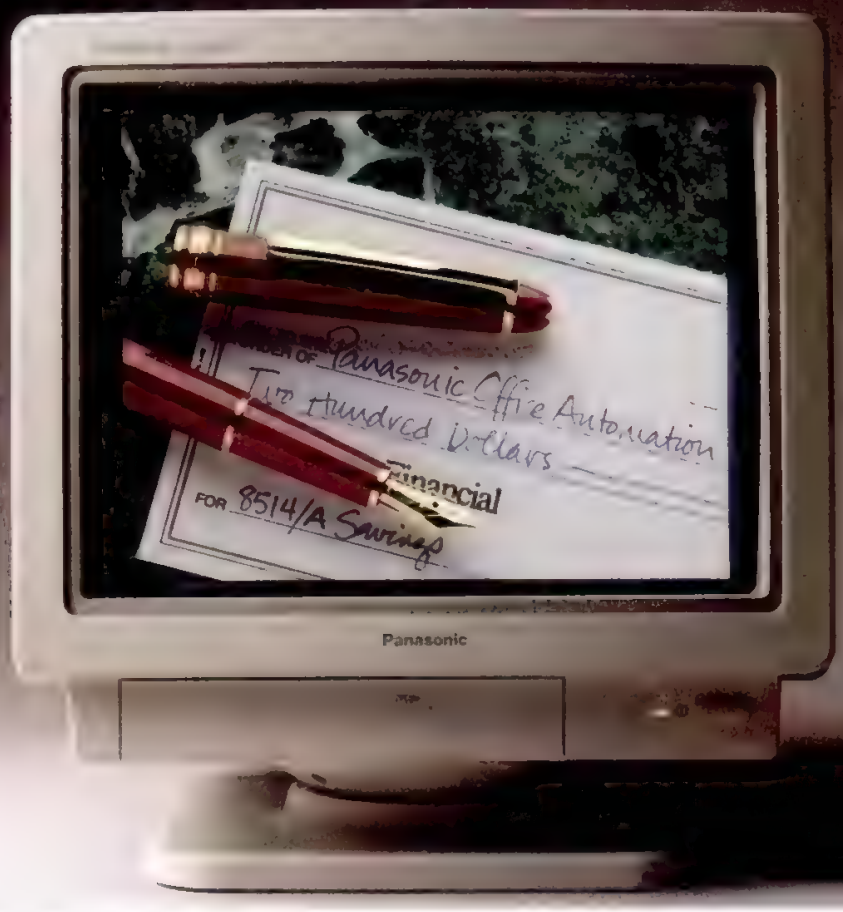

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M3-PCM

by
Craig Stinson

Spreadsheets

CUSTOMIZING EXCEL

I've been wrestling with *Microsoft Excel*'s documentation, trying to add an option to change directories when I start the program. I dislike fumbling through the File Open dialog box, and yet I don't want to keep my spreadsheets in a single directory underneath the *Excel* program files.

I'd really like to use the ADD.BAR macro option to do this, but I can't seem to get it to work. Can you help?

August Cassano
Brooklyn, New York

Excel has six standard menu bars: a short form and a long form for both worksheets and macro sheets, a Nil menu bar that appears only when all document windows have been closed, and a menu bar for the Info Window. You can use the ADD.BAR macro command to create additional menu bars for your own custom applications.

To solve the problem Mr. Cassano describes, you don't need a new menu bar; you need to add a Change-directory menu to one or more of *Excel*'s standard menu bars. The new menu will include commands to switch to each of your working directories, as Figure 1 illustrates.

The macro command that adds a new menu to an existing menu bar is ADD .MENU. Figure 2 shows a simple macro that illustrates its use.

ADD.MENU requires two arguments. The first specifies the menu bar to which you want to add your menu. Menu bars are identified by number; the table below shows the number used by each of *Excel*'s six standard menu bars.

Menu bar	Number
Worksheet/macro sheet,	
long form	1
short form	5
Chart, long form	2
Chart, short form	6
Nil	3
Info Window	4

- **CUSTOMIZING EXCEL:** Microsoft Excel's ADD.MENU command lets you put your directories where your menus are.
- **PRINTING NOTES BY COLUMN:** Microsoft Excel's Multiple selection option lets you print notes by column rather than by row.

The commands in lines 2 through 6 of Figure 2 add a new menu to each of five menu bars (all but the Info Window menu bar).

The second argument is a reference to a range on the macro sheet that defines the contents of your new menu. This range must contain at least the two columns shown in lines 10 through 12 of Figure 2. Additional columns can be used to specify status-bar messages and custom Help topics. Our new menu will be self-explanatory, so we don't need these options.

The first entry in the first column (cell A10) states the name of the new menu. Each subsequent entry in the first column lists a command on the new menu. Our macro creates a menu named Chdir with two commands: Budgets and Actuals.

The ampersands in cells A10, A11, and A12 won't be displayed as ampersands in the new menu. Instead, they'll cause *Excel* to underline the first letter that follows each of them so that keyboard users can open the menu. Chdir, for example, will have an underlined C, and you would open it by pressing Alt-C. If you only use a mouse, omit the ampersands.

The cells in the second column of the menu-definition area, B11 and B12, tell *Excel* what to do when menu commands are chosen. Each cell specifies the full pathname of another macro. When the command defined in A11 is chosen, the macro named in B11 is executed.

These two additional macros, named Budgets and Actuals, use DIRECTORY commands to change the default directory. The macro in A14:A16 makes the current directory C:\BUDGETS, while the macro in A18:A20 logs on to C:\ACTUALS.

Each of the four functional areas in Figure 2 is a named range: A1:A8 is named auto_open, A10:B12 is named Chdir,

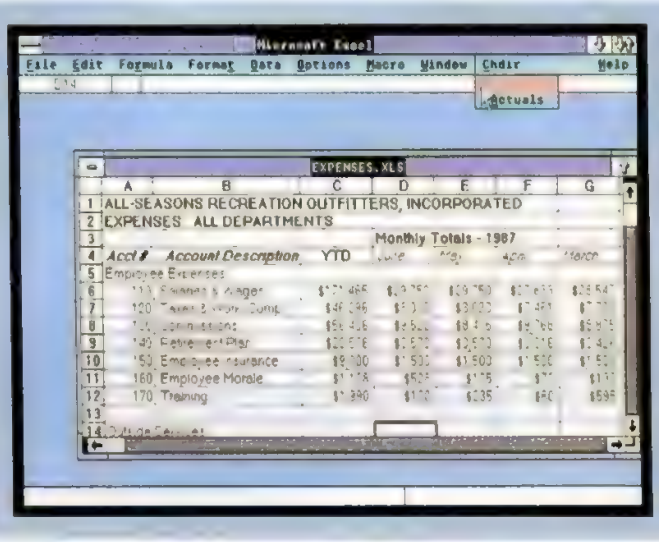

Figure 1: The screen to the left shows a worksheet menu bar that includes the menu created by the macro in Figure 2.

CHANGE DIRECTORIES WITH A MENU — COMPLETE LISTING

```
          A                                  B

 1  auto_open
 2  "=ADD.MENU(1,A10:B12)"
 3  "=ADD.MENU(2,A10:B12)"
 4  "=ADD.MENU(3,A10:B12)"
 5  "=ADD.MENU(5,A10:B12)"
 6  "=ADD.MENU(6,A10:B12)"
 7  =HIDE()
 8  =RETURN()
 9
10  &Chdir
11  &Budgets                          CASSANO.XLM!budgets
12  &Actuals                          CASSANO.XLM!actuals
13
14  Budgets
15  =DIRECTORY("c:\budgets")
16  =RETURN()
17
18  Actuals
19  =DIRECTORY("c:\actuals")
20  =RETURN()
```

Figure 2: The macro above uses the ADD.MENU command to create a menu that lets you change directories with only two clicks of the mouse.

A14:A16 is called Budgets, and A18:A20 is called Actuals.

Because the main routine, A1:A8, is named auto_open, *Excel* treats it as an autoexecute macro. This means that as soon as the macro sheet is loaded into memory, the routine is executed. A HIDE() statement is included at A7 to put the menu sheet out of sight so that it won't get in your way after it has done its work. Figure 2 is only a model of how to set up a Chdir menu. For your own system, you will want to modify the menu-definition area (A10:B12) and the routines that define your menu commands.

Once you've got the macro working, you'll have a Chdir menu on each of *Excel*'s standard menu bars (except for the Info Window bar). You'll be able to switch directories any time you want to without having to contend with the directory list that appears in *Excel*'s File Open dialog box.

You can have this macro run automatically each time you start a session in *Microsoft Windows* by making a small modification to the *Windows* initialization file, WIN.INI. First, for safety's sake, make a backup copy of WIN.INI. Then open WIN.INI with a text editor such as *Windows Notepad*. In the section headed [windows], look for a line that begins:

```
run=
```

At this point add the name of your macro sheet to that line. For example, if your macro sheet is called CASSANO.XLM, you would make the line read

```
run=CASSANO.XLM
```

If some other filenames already appear on the run= line, all you have to do is add a space followed by the name of your macro sheet to the end of the line.

> *Microsoft Excel*'s ADD.MENU command lets you add menus to existing menu bars.

PRINTING NOTES BY COLUMN

When I do my budgeting in *Microsoft Excel*, I use the Formula Note command to save information that is related to each cell in the budget. *Excel* prints these spreadsheet notes in row order. So, for a 3-column, 2-row table, the program would print A1, then B1, then C1, then A2, then B2, then C2. But I prefer to see all the notes for a given column together. So I wrote a macro (shown in Figure 3) that forces *Excel* to print them my way.

The macro uses the GET.DOCUMENT() function to determine the last row and column that are used in the worksheet. With the help of a text variable, dummy, and a FOR loop, it selects the first column, then extends the selection to include the second column, the third, and so on. The resulting multiple selection treats each column as an individual range, even though the columns are adjacent to one another.

After creating the multiple selection, the macro prints the notes by column. Then it selects the entire worksheet and defines that as the print area.

Thomas W. Weber
Elyria, Ohio

Excel's multiple-selection feature is what allows this macro to defeat the program's normal row-by-row printing order. *Excel* prints each component of a multiple selection separately, even if the components add up to a single contiguous range.

Let's take a quick walk through the macro to see how it works. Line 1 is just a name for the macro. Line 2 is a bit more complex—it creates a variable named dummy and assigns it the text equivalent of an R1C1-style reference to the first column in your spreadsheet. It does this by using the GET.DOCUMENT() function to find the last nonblank row.

GET.DOCUMENT () is a handy function that returns information about a particular worksheet, macro sheet, or chart. The numeric argument in the function tells *Excel* what kind of information you want. The macro discussed here uses GET .DOCUMENT(10) and GET.DOCUMENT(12), which will return the numbers of the last-used row and column, respectively. You can apply GET.DOCUMENT () to a specified document or, by ommiting the *name_text* argument, to the current document. Since Mr. Weber's macro omits the *name_text* argument, you must be sure that the worksheet whose notes you want to print is the active window at the time you execute the macro.

Lines 3 and 5 enclose a loop that processes line 4 once for each populated column in the worksheet, excluding column 1. This extends the text value assigned to dummy. Thus, if your worksheet has three columns and five rows, dummy reads

```
"R1C1:R5C1,R1C2:R5C2,R1C3:R5C3"
```

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PROCESSOR: PC Magazine recommends a 386SX processor, particularly if this is your only computer. We agree completely. Your ZEOS Portable uses the powerful Intel 386SX running at zero-wait state. Delivering true 32-bit processing power, the 386SX allows you to run the software of today *and* the software of tomorrow.

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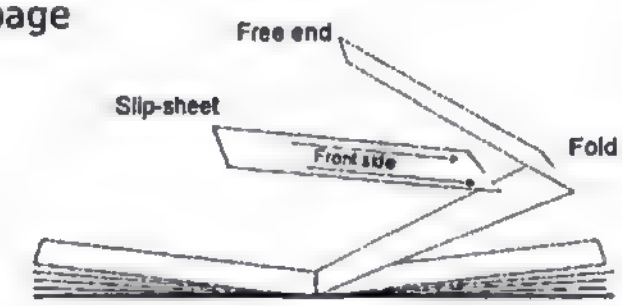
4. Close the page and slip-sheet



1. Open the foldout page
2. Insert this sheet with
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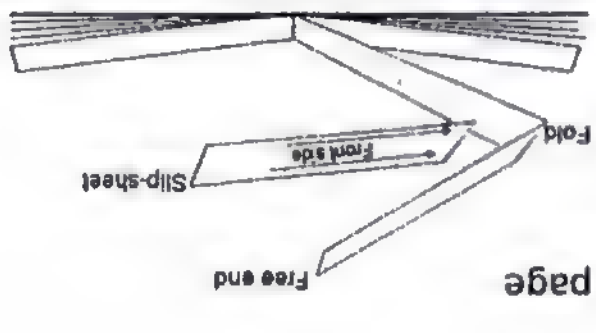
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



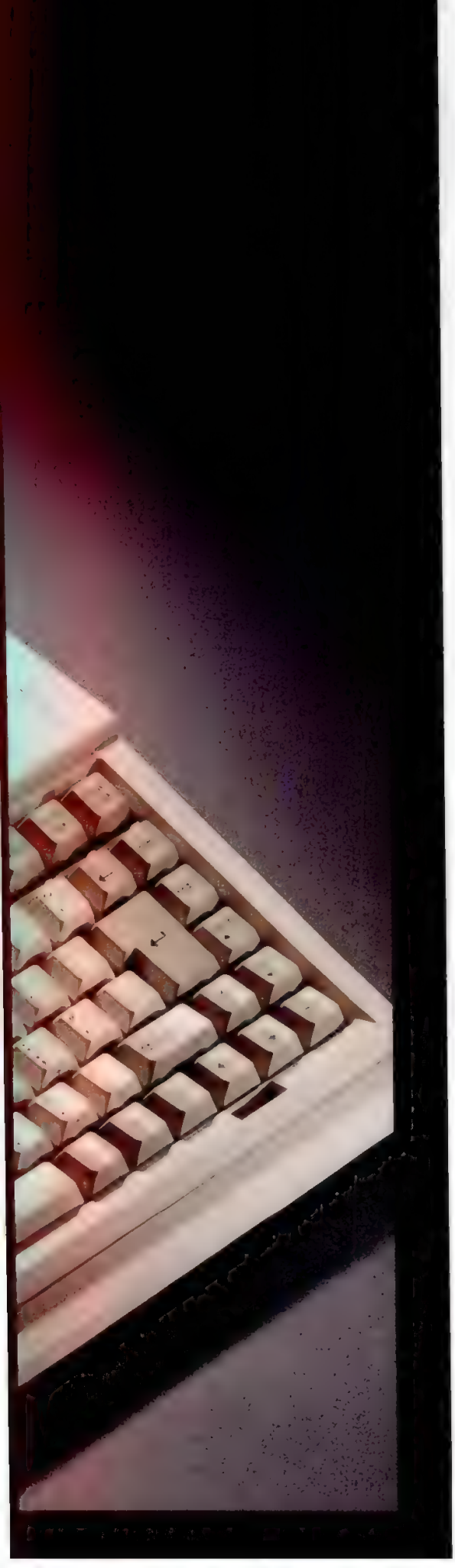
GbsSlipBack-001B

Back

1. Follow instructions on the other side

Inverted Back

1. Follow instructions on the other side



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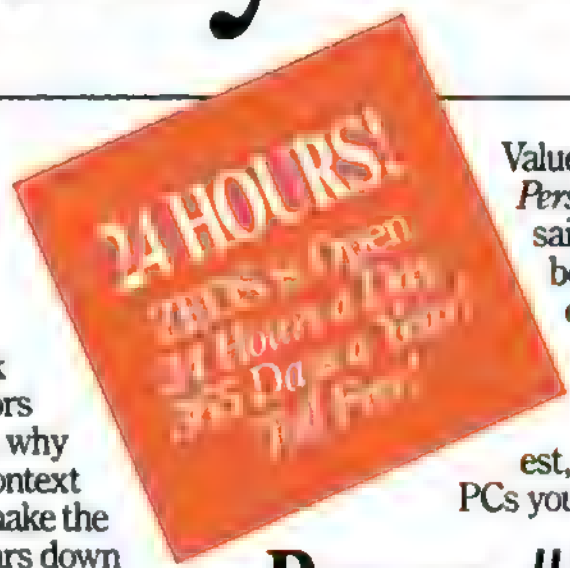

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a. Your Personal Information

Requested Line of Credit $ _____

Your Name _____ First Initial Last **Date of Birth** _____ Mo. Day Yr.

Present Address _____ Street Apt. # City State Zip

Social Security Number _____ ( ) Home Phone

Date of Residence _____ Month Year **Monthly Payment** $ _____ ☐ Buy ☐ Rent ☐ Other

Previous Address _____

_____ **Dates of Residence** _____ From To

Your Employer _____
(If self-employed, see rear panel.)

Date of Employment _____ Mo. Yr. **Position** _____

Monthly Income _____ Gross $ Net $

Employer's Address _____ Street

_____ City State Zip ( ) Business Phone

Previous Employer _____ **Address** _____

_____ **Dates of Employment** _____ From To

Other Income _____ I have received since (Date) _____
Income from alimony, child support or separate maintenance payments need not be disclosed if you do not wish to have it considered as a basis for repaying this obligation.

Monthly Income _____ Gross $ Net $

Name and Address of Nearest Relative Not Living With You _____

_____ Relationship _____

b. Credit Information

Include joint information, if joint account requested.

Bank Account _____ Bank Name ☐ Checking ☐ Savings

Address _____

Bank Account _____ Bank Name ☐ Checking ☐ Savings

Address _____

Bank Loan Reference _____ Bank Name Address

_____ Payment _____ Balance _____

Bank Card Reference _____ Bank Name Address

_____ ☐ VISA ☐ Mastercard Payment _____ Balance _____

(please check appropriate box):

☐ **Joint Credit** with another person. Complete all information.
☐ **Individual Credit** but rely on income or assets of another person as a basis for repaying the credit requested. Complete all information
☐ **Individual Credit** Complete sections "a" and "b" only.

Please complete all appropriate sections, *providing at least two years' residence and employment history.* This will enable your information to be processed as quickly as possible. If you are self-employed, please be sure to complete section "d" below.

Other Credit Card Reference _____ Bank Name Address

_____ Payment _____ Balance _____

Other Credit References _____ Payment _____ Balance _____

Account No. _____ Expires _____

Driver's License No. _____ State _____ Expires _____

c. Joint Personal Information

Joint Name _____ First Initial Last

Date of Birth _____ Mo. Day Yr. **Social Security Number** _____

Address _____ Street Apt. #

_____ City State Zip

Date of Residence _____ Mo. Yr. **Home Phone** ( ) _____

Employer _____

Date of Employment _____ Mo. Yr. **Position** _____

Monthly Income _____ Gross $ Net $

Employer's Address _____ Street

_____ City State Zip ( ) Business Phone

d. Self-Employed Information

Complete this section only if you are self employed.

Business Name _____

Business Address _____

☐ Proprietorship ☐ Corporation ☐ Partnership **Business Phone** ( ) _____

Description of Business _____

Your Position _____ **In Business Since** _____

Your annual income from business _____ **Business' annual income** _____ (gross) (net)

You must provide at least one of the following:

1. Business Bank _____

( ) _____ Telephone _____ Personal Banker's Name

2. Accountant's Name _____

( ) _____ Telephone

3. Financial statement on business attached.

(EXC. AK, & HI)

CIRCLE 115 ON READER SERVICE CARD

Lines 6 and 7 turn dummy into a multiple selection and set the print area. Line 8 performs the printing; the arguments in this statement tell *Excel* to print one copy of the notes in all pages in the selection in final quality and in preview mode. If you want hard-copy output, change the TRUE argument to FALSE.

Lines 9 and 10 replace the multiple selection with a single selection of the entire worksheet, then set the print area to this new selection. This will allow you to follow the note printing with output of the worksheet itself. Line 11 will terminate the macro.

As an alternative, you could duplicate Mr. Weber's trick manually by selecting the first column of a worksheet, then holding down the Ctrl key and painting each column in turn with the mouse. After creating the multiple selection this way, you would choose Options Set Print Area, then print your notes.

While we're on the subject of printing in *Excel*, I can't resist mentioning a favorite productivity macro of my own

```
        A
1    Default print
2    =PRINT()
3    =RETURN
```

This item simply runs the Print command with all its default settings—one copy of the current worksheet (or the print area, if you've defined one) in final-quality hard copy. I recommend this macro if you hate having to confirm a dialog box when all that's wanted is a default printout.

NOTES BY COLUMN — **COMPLETE LISTING**

```
        A
1    NOTES_BY_COLUMN
2    dummy="R1C1:R"&GET.DOCUMENT(10)&"C1"
3    =FOR("index",2,GET.DOCUMENT(12))
4    dummy=dummy&",R1C"&index&":R"&GET.DOCUMENT(10)&"C"&index
5    =NEXT()
6    =SELECT(dummy)
7    =SET.PRINT.AREA()
8    =PRINT(1,,,1,FALSE,TRUE,2)
9    =SELECT("R1C1:R"&GET.DOCUMENT(10)&":C"&GET.DOCUMENT(12))
10   =SET.PRINT.AREA()
11   =RETURN()
```

Figure 3: This macro uses *Microsoft Excel*'s multiple selection feature to defeat the row-by-row order in which the program normally prints notes.

HINTS, TIPS, QUESTIONS

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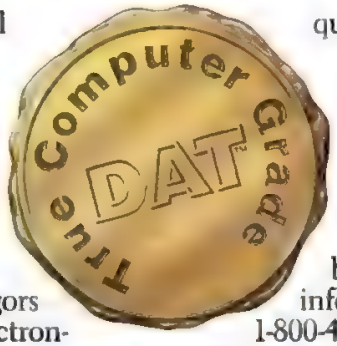

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CIRCLE 186 ON READER SERVICE CARD

by
Craig L. Stark

The Working Word

INCREASED READABILITY

As you probably know, the display drivers that work with *Microsoft Windows* use an eight-color palette. The eight colors are defined as high-intensity primaries mixed with low-intensity white. For instance, blue is defined as rgbRGB=111001, and white is rgbRGB=111111. While this scheme does give the brightest possible image on the screen, it nonetheless tends to overdrive most monitors: even my NEC MultiSync 3D displayed a bit of distortion and flicker with these settings.

A standard patch that changes the definitions to pure colors is available on CompuServe. In that palette, blue is rgbRGB=001001, but white is still rgbRGB=111111. I tried this patch, and while it may work for some, I didn't find the resulting palette definition useful.

Instead, I switched all colors to medium intensity, with blue defined as rgbRGB=000001 and white as rgbRBG=000111. This made a tremendous difference in readability. It worked especially well in the 800-by-600 Super VGA mode, but it was also my choice for the standard VGA mode.

To implement the change, scan WIN-200.OVL (or, if you are using slow boot, DISPLAY.DRV) for the following byte string:

```
3c 3a 3e 39 3d 3b 3f 00
```

and replace it with

```
04 02 06 01 05 03 07 00
```

Note that this string occurs four times in the file.

Ed Russell
Princeton, New Jersey

- **INCREASED READABILITY:** Modifying the Windows palette can make your screen easier to read.
- **PERFECT PARALLELS:** A simple WP 5.0 macro can help keep running translations straight.
- **CHECKOFF BOXES IN WP:** What the manual doesn't tell you about creating these handy forms-oriented items.

If you don't work with DEBUG regularly, Mr. Russell's instructions may seem a bit terse. In your \WIN subdirectory, copy WIN200.OVL (or DISPLAY.DRV) to another filename, for example, WIN200.OLD. Now that you have a failsafe insurance policy against any unexpected catastrophe, enter

```
DEBUG WIN200.OVL
```

and, at the hyphen prompt, hit R and Enter. The resulting display will give you the segment:offset address at which the file begins—something on the order of 2F41:0100. (The 2F41 will vary, so I'll refer to it below as *xxxx*.) To search for the string, enter the following sequence at the hyphen prompt:

```
s xxxx:100 ffff 3c 3a 3e 39 3d 3b
 3f 00
```

You'll get two hits in this first segment if you've got the same version of *Windows* as I do. Write down the complete addresses. On my machine they were, 2F41:45B2 and 2F41:45BA.

The next two segments (3F41: and 4F41:) will yield no matches for the string (again, this may vary with version), but three segments up (5F41:) you'll find the remaining two occurrences of the string. Write these addresses down, too. If you look at the addresses carefully, you'll note that, given the 8-byte search string, the second address actually begins where the first leaves off, and the same is true with the fourth and third. This simplifies entering your substitute string.

Assuming that the first string was found at the same address as mine, you would now enter

```
e 2F41:45b2
```

at the hyphen prompt. The display will then show

```
3c.
```

which is the first byte of the search string, followed by a period. After the period, type in the first value of the replacement string—04—followed by a space. As soon as you do, you'll see the next original byte—3A—displayed. After its period, type in the second byte of your substitute string—02—and another space. Continue entering the new values, followed by a space, until you have all eight values (the 00. terminator is the same) of the new string, and start right over, since the two sets of addresses are successive. After the second round, hit Enter.

You'll need to repeat the process for the other pair of addresses; as before, these two strings are also successive. Again, hit Enter when you have substituted the two sets of 8 bytes. Then, once you see the hyphen prompt, hit w (Write), Enter, and q (Quit), Enter.

You've now patched WIN200.OVL per Mr. Russell's suggestion. I agree that it produces an improvement in readability, though on my Sony CDP-1304 the patch doesn't seem to make quite as much of a difference as it does on my older NEC MultiSync monitor.

The decision to emulate writing on white paper, while a natural one for *Word for Windows* to make, heightens the readability problem. Blasting all the pixels (111111) to create an intense white produces a slight halo effect that tends to obscure the already thin lines that compose the letters in normal point sizes. Reducing

the intensity reduces the haloing, though it won't fix the other problems with *Windows*' graphically based text fonts. (These problems don't look as obvious in the electronically processed figures we printed to illustrate them as they will on your screen.)

PERFECT PARALLELS

In Canada, a document written in English or French is often sent out to be translated. The translation comes back as a separate file, so you then have two separate documents. However, often what you really need to end up with is a single document with the two versions displayed in side-by-side columns.

The *WordPerfect* 5.0 macro shown in Figure 1 prompts you for the names of the two documents (the first goes into the left column) and automatically merges them into parallel columns.

The only assumptions made by the macro are that all paragraphs are separated by two hard returns and, of course, that there are an equal number of paragraphs in each version of the document. When you save the joined file, remember to give it a new name: unless otherwise directed, *WordPerfect* will store it with the filename of the first document. By keeping the documents in separate (as well as merged) form you can use the spell checker without getting a constant interruption from the "wrong" language.

Greg Erwin
Aylmer, Québec
Canada

PC MAGAZINE This is a good solution to a common problem, especially since *WordPerfect* 5.0's windowing capabilities are limited. Although you can view two documents on the same screen, you can't split the screen vertically, only horizontally—not an ideal environment for the comparison of two files. Happily, *WordPerfect*'s windowing abilities are greatly expanded in Version 5.1.

But this macro adds a further advantage over editing in windows, whether horizontal or vertical. When you're working with two files at the same time, it is much easier to not have to jump between windows and scroll each file separately to keep them aligned. This technique could be equally useful for editing any files, comparing old and new versions, checking information in one file against another, and so on.

CHECKOFF BOXES IN WORDPERFECT

Many people use little empty boxes as bullets in reports or promotional pieces. And anyone who works with questionnaires—in market research, psychological testing, or even in doing a simple in-house survey of employee opinions—needs to be able to create answer boxes that can be checked or filled in.

WordPerfect does not tell you how to make such answer boxes. The logical method is with the Line-Draw feature. But if you've tried it using early releases of Version 5.0 and a dot matrix printer, you know what a trick it is to get the box to stay whole. The later updates seem to have improved that aspect, although the method is still clumsy, and an innocent Enter still can split your box in two. And whatever release you have, if you manage to get the boxes to sit on the same baseline as your text, it will really make your day.

The simplest, safest, most flexible way to create a box is with the Graphics feature, recording the strokes as a macro (Ctrl-F10 to start and end it), to which you might give the name *checkbox*. This is how you can create a square box just a bit taller than pica type (10-pitch): Press Alt-F9, 1 for Figure, and 1 for Create. Select 3 for Type and choose 3 for Character; select 4 for Vertical Position and choose 3 for Bottom; and select 6 for Size, choose 3 for Both width and height. Now type in .16 (for width), Enter, .16 (for height), Enter, and then F7 to exit.

You won't see the actual box on your editing screen, but you will see a filled rectangle representing the box in its actual location, which is all you normally need; to see the actual box, just use the preview screen.

If you work with questionnaires involving varying numbers of answer categories and separate answer sheets, it is simple enough to create a mother macro that nests your original box-macro as many times as you will need a box symbol for a given question. For example, if you have a question with three response categories, your mother macro would nest or loop the original one-box macro three times using predetermined spacing between boxes.

Herbert Kay
West Caldwell, New Jersey

PC MAGAZINE In checking Mr. Kay's suggestion, I found that a size dimension of .12 seemed to make a better match for the 10-pitch Courier font of my HP LaserJet II, but this is obviously a personal matter. More important, users of *WordPerfect* 5.1 may find it easier simply to drop in the hollow box contained in *WordPerfect*'s Typographic Symbols set, using *WP*'s Compose feature. You can do this with the keystroke sequence Ctrl-2,4,38. Ctrl-V is an alternative to Ctrl-2, and this sequence could also be recorded as a macro.

TIPS FROM WORKING WORDSMITHS

Tell fellow users about your latest word processing tips, and we'll pay you $50 for any tips we print. Please send your letter on a disk along with a printout. Mail your contributions to The Working Word, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column). ■

GLUE.WPM — **COMPLETE LISTING**

```
{Retrieve}{PROMPT}Enter document #1 for left column===>  ~{PAUSE}
{Enter}{Switch}{Retrieve}
{PROMPT}Enter document #2 for right column===>  ~{PAUSE}{Enter}
{Switch}
{DISPLAY OFF}
{Math/Columns}dtb{Enter}c
{ON NOT FOUND}{GO}end~~
{LABEL}start~{GO}loop~
{LABEL}loop~{Search}{Enter}{Enter}{Search}
{Backspace}{HPg}
{Switch}{Block}{Search}{Search}{Move}bm{Switch}{Enter}
{Search}{Search}{Backspace}{HPg}
{GO}start~
{RETURN}
{LABEL}end~{Home}{Home}{Down}{HPg}
{Switch}{Block}{Home}{Home}{Down}{Move}bm{Switch}{Enter}
```

Figure 1: GLUE.WPM is a *WordPerfect* 5.0 macro that allows you to arrange an original text and a translation (or any two similarly related documents) in parallel columns. This provides a convenient way to compare different versions of a document.

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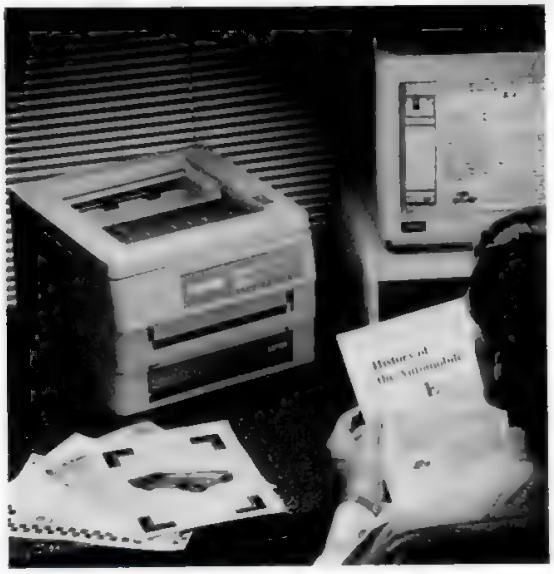

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CIRCLE 177 ON READER SERVICE CARD

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CIRCLE 384 ON READER SERVICE CARD

by
Neil J. Rubenking

User-to-User

PARENT TRAP

In a previous User-to-User column, there was a suggestion that it is useful to add double dots (..) to your path statement, for example

```
PATH ..;C:\DOS;C:\UTILS
```

But including double dots in your path doesn't always work correctly. If the .. search finds a batch file and that file contains a CD command that changes the current directory, DOS will report "Missing batch file" after executing the CD command. It appears that DOS creates a relative link under these conditions, and when the current directory changes, DOS can no longer find the file.

Including a double dot (..) in your PATH statement can also create some interesting situations in which batch files sometimes work and sometimes don't, depending on the directory from which they have been executed. However, if you try putting the .. at the *end* of the PATH statement in the following way:

```
PATH C:\DOS;C:\UTILS;..
```

you can correct this inconsistency, since all of the absolute paths are tested before the relative one.

Terence Brady
Laguna Hills, California

DOS uses the double dot (..) as a symbol for the parent of the current subdirectory. If you put a double dot in your path, DOS will always scan the parent of whatever directory is current when searching for programs. You can substantially shorten your path string by simply keeping all of your data files in subdirectories under the application programs that created them. Just switch to a data directory, then run the corresponding program. DOS will find the program in the parent directory.

When DOS runs a batch file, it remembers the directory it's in. The batch file can change to another directory or drive, but DOS still knows where to look for the next line. Well, most of the time. When DOS finds a batch file via a double dot in the path, it doesn't translate it into the full pathname of the parent directory. It just remembers that it should look in the parent. When you change to a new directory, DOS looks at that directory's parent and fails to find the batch file.

To avoid this situation, keep *all* of your batch files in one directory and put that directory on the path. Do *not* create any subdirectories under the batch directory. Now the problem just can't happen, and DOS can't get lost.

- PARENT TRAP: Using a double dot (..) in your PATH can have unexpected results.
- NOT ENOUGH FILE HANDLES: A DOS bug can consume file handles when you redirect output to NUL.
- A CLEAN SLATE: There's more than one reason to wipe your computer's memory clean.

NOT ENOUGH FILE HANDLES

Some time ago in User-to-User, you presented the following productivity tip. "To hide *all* [program] output [in a batch file] use the line CTTY NUL before the lines to be hidden and CTTY CON after."

However, because of a bug in DOS, this technique causes problems when your batch file loads a TSR (terminate-and-stay-resident) program. For example, if you run the DOS batch program below, DOS will leave two additional file handles open—NUL and CON, respectively—and you'll have two fewer file handles available for your application programs.

```
@ECHO OFF
CTTY NUL
ASSIGN A=B
CTTY CON
```

In addition, if you run the following batch lines in which you individually redirect the output from each TSR program to the NUL device, DOS will leave two more file handles open.

```
ASSIGN A=B > NUL
GRAPHICS > NUL
```

When a program terminates and stays resident, DOS flushes all file buffers and closes any file handles for files or devices owned by the process. However, DOS is not smart enough to check to see if it opened any file handles *itself*. As a result, DOS uses up a file handle, and your programs are left with one less file handle. The same thing happens if you load a TSR program from the DOS prompt and redirect its output.

Darren P. Shelcusky
Westland, Michigan

This DOS quirk can cause surprising problems. Suppose you depend on an application that needs ten file handles. One day you decide to clean up your AUTOEXEC by hiding its operation with CTTY NUL. Suddenly you find that your application won't run anymore. If you're lucky, it fails to load and announces "Not enough file handles." But some programs don't notice the shortage of file handles until they try to open one too many files. You might end up being unable to save your work—disaster!

It should be possible for a TSR to avoid this problem by closing the standard input and output devices before going resident. However, almost no TSR programs do this. For now, just avoid redirecting output when you're loading RAM-resident programs. If you want to hide their messages, try putting the ANSI code for invisible text

into your PROMPT string. A line like

```
PROMPT $e[0;8m
```

will hide the output of many programs. Of course, you have to have ANSI.SYS loaded to use this technique, and you have to remember to restore visibility with a line like

```
PROMPT $e[0m$p$g
```

A CLEAN SLATE

You can use a program like Peter Norton's Wipefile to erase sensitive disk files permanently, but such programs can't prevent someone from accessing data that's still in your computer's memory. If you create a document with your word processor, print it, exit, and delete the file, you may feel safe, but a copy of that document still exists in memory. A skilled user could use DEBUG or a utility to recover it. WIPEMEM.COM prevents this by erasing all the memory available to programs running under DOS.

The workings of WIPEMEM are simple. First, it reduces the stack to the smallest possible amount. It calculates the segment just beyond the end of its own program code and saves it in BX. Using BIOS interrupt 12h, it calculates the top segment to be erased. It then starts at the top, erasing memory in 16-byte increments until it reaches the bottom segment stored in BX. WIPEMEM then exits to DOS, which will need to reload COMMAND.COM. You can create WIPEMEM by using the DEBUG script shown in Figure 1.

Jeff Siegel
Easton, Pennsylvania

Picture it—you leave your office carrying a top secret document after carefully wiping all traces of the document from your disk. But a secret agent enters and extracts a copy of the document from your PC's memory. Unlikely? Perhaps, but there's another reason to put WIPEMEM in your arsenal of utilities.

Certain kinds of program bugs will occur intermittently, depending on what was in RAM *before* the buggy program. This kind of bug is tough to track down, because you can't re-create it when you want to. Changing your CONFIG.SYS or AUTOEXEC.BAT can cause the bug to appear or disappear. What you need is a way to *control* what's in RAM.

WIPEMEM.SCR — COMPLETE LISTING

```
NWIPEMEM.COM
A100
MOV  SP,0178        ;move the stack to just above the program
PUSH CS
POP  AX
ADD  AX,0012        ;figure the lowest segment ABOVE the program
MOV  BX,AX          ;...and put it in BX
INT  12
MOV  CL,06
SHL  AX,CL          ;figure the highest segment in use
MOV  DX,AX          ;...and put it in DX
MOV  AL,0           ;fill RAM with 0 -- you can change this
DEC  DX
PUSH DX             ;start of loop
POP  ES
XOR  DI,DI
MOV  CX,0010
REPZ
STOSB               ;fill 16 bytes with what's in AL
DEC  DX
CMP  DX,BX          ;reached the lowest segment?
JNZ  0115           ;if NOT, loop back to start
MOV  AX,4C00
INT  21             ;terminate with error code of 0

RCX
28
W
Q
```

Figure 1: Use DEBUG to create WIPEMEM.COM, a small program that cleans out memory by filling all of your available RAM with zeros.

The original WIPEMEM filled your RAM with whatever happened to be in the constantly changing AX register. I modified it to fill all available RAM with zeros. If you have a program that behaves erratically, try executing WIPEMEM just before you run it. You can change the byte that's used to fill RAM—just change the 0 in the line `MOV AL,0` to the byte of your choice.

> If you create a document with your word processor, print it, exit, and delete the file, you may feel safe, but a copy of that document still exists in memory.

Do note that there's some danger that WIPEMEM will wipe out more than it ought to. You'll find an occasional RAM-resident program that loads at the *top* of available memory instead of at the *bottom*. Such a program could get wiped out by WIPEMEM. Note also that WIPEMEM affects only conventional memory, not extended or expanded memory.

To create WIPEMEM.SCR, use an ASCII text editor like *PC Magazine*'s TED.COM, or use a word processor that lets you save in ASCII format. Be sure to leave a blank line before the line RCX and after the final Q. Now redirect the script into DEBUG with the command

```
DEBUG < WIPEMEM.SCR
```

Watch carefully—if you see any error messages, you'll have to double-check your script and try again.

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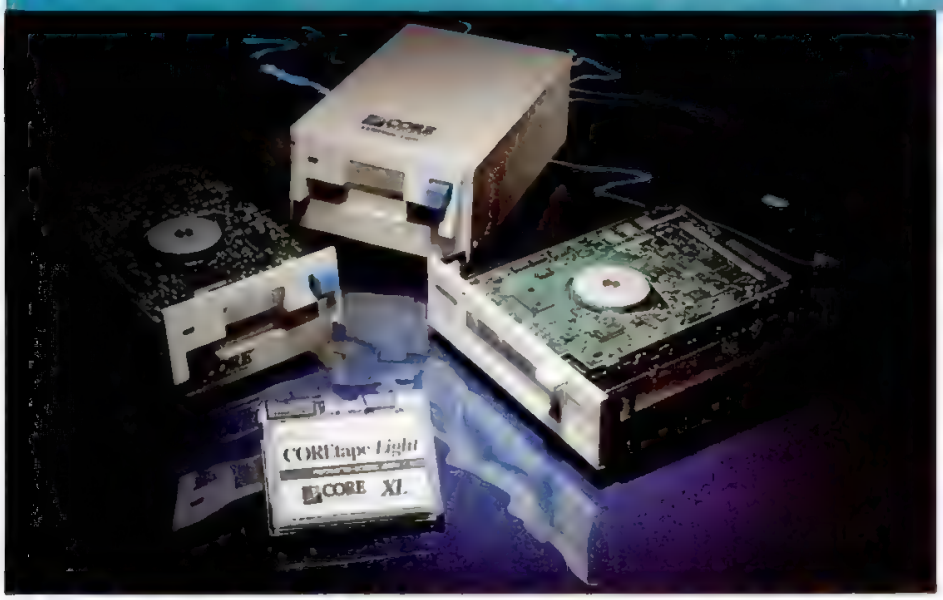

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Tutor

ANOTHER FIX FOR LASERLST

I think there's an error in the instructions that appeared in the February 27, 1990, Tutor column for modifying LASERLST.COM to work with LaserJet IIP printers. The offset addresses in the DEBUG commands

```
E 0282 1B,"&16E"
E 0287 1B,"171F"
```

were off by 1. They should have read

```
E 0281 1B,"&16E"
E 0286 1B,"171F"
```

Correct?

Thomas J. Curphey
Hanover, New Hampshire

Well, yes, you're right on target. My apologies for any inconveniences this may have caused. The truth is that Hawkeye gave me the code for this. I guess I should have checked it more closely.

THE NUL DEVICE

What is the NUL device? What does it do? Is there any gainful purpose to put it to?

Raymond C. Wheatley
Holland, Pennsylvania

The NUL device is literally a device that does nothing. It's most often used as a destination to send output to when you don't want output from a program run from a batch file to be seen. For example, the command

```
COPY *.* E: >NUL
```

which might be used to copy files to a RAM disk, redirects standard output to the NUL driver and hides the resulting "File(s) copied" message.

It's easy to disassemble the NUL device driver with DEBUG and see how it works. It carries a device attribute word of 8004h, which says that it's a character-type device and that it's the current system NUL driver. Like other device drivers, NUL contains two entry points: the offset of its strategy routine and the offset of its interrupt routine. In PC-DOS 3.3, the strategy routine consists of the code sequence

```
OR  WORD PTR ES:[BX+03],0100H
RETF
```

which sets bit 8 of the return status word in the request header to signal that the driver's work is done (a task carried out by the interrupt routine in most device drivers).

The interrupt routine, which is called just after the strategy routine, does nothing more than execute a RETF instruction—the same RETF, in fact, that ends the strategy routine. The result is that any data sent to the driver is simply absorbed.

- ANOTHER FIX FOR LASERLST: The instructions for modifying LASERLST's code need a small adjustment.
- THE NUL DEVICE: This device driver doesn't do anything, but it's surprisingly useful.
- REDIRECTING PRINTER OUTPUT: One of our utilities is just what you need to send printer output to a file.
- DISTINGUISHING AMONG CPUs: Here's how a program can tell what type of CPU it's running on.

REDIRECTING PRINTER OUTPUT

How do you redirect LPT1 output to a file? I know how to do this inside a program, but not how to force an existing program to do it. Is there a simple way?

Victor I. Davis, Jr.
Gilbert, Arizona

You do it with a TSR that intercepts characters transmitted with interrupt 17h—the BIOS interface to the parallel port—and reroutes them to a file. It's not easy, because doing file I/O from inside a memory-resident interrupt handler requires that a program work around DOS's reentrancy restrictions. But the technique works with the vast majority of programs out there, because almost all of them, including DOS itself, use interrupt 17h to output data to the printer.

Who says we're above plugging our own utilities? Tom Kihlken's PRN2FILE utility, published in *PC Magazine*'s December 22, 1987, Utilities column, sounds like just what you're looking for. It allows output sent to any parallel printer to be captured to a file. If you can't find a copy on a local bulletin board, you can sign on to PC MagNet and download a copy from there. Look for it in the Utilities library.

DISTINGUISHING AMONG CPUs

How can a program tell whether it's running on a 386 or not? I'm writing some 386-specific software, and I'd like to start the program with a simple test to determine whether or not the CPU is a 386 and, if it's not, just exit with a harmless error message.

I've tried using the machine identification code that's stored in ROM at location F000:FFFE, but manufacturers don't seem to use this code consistently. I'm left feeling that there has to be a better way.

Jeffrey J. Hamilton
Jessup, Maryland

There is. By relying on documented differences in the chips themselves, a program can tell just what type of CPU it's running on.

You can differentiate between protected-mode CPUs (286, 386, 486, and 386SX) and real-mode CPUs (8088, 8086,

80188, 80186, and the NEC V20 and V30) with a simple test that determines whether SP is decremented before or after a PUSH. Real-mode CPUs decrement SP before a value is PUSHed; protected-mode CPUs decrement it after the PUSH, even if they're running in real mode. (The terms *real mode* and *protected mode* are used here only to distinguish between chip families.) The simple code sequence

```
PUSH    SP
POP     AX
CMP     SP,AX
JNE     IS_8086
```

separates 286/386/486-class chips from 8086-class chips. If a branch occurs, then the CPU belongs to the 8086 family; if it doesn't, the CPU is a 286, 386, or 486.

Once you've gotten this far, another test is required to distinguish 286s from 386s and 486s. Here's the key: the NT (Nested Task) bit (bit 14) in the flags register can't be set in real mode on a 286, but it can on a 386 or 486. If the test

```
PUSHF
POP     AX
OR      AX,4000
PUSH    AX
POPF
PUSHF
POP     AX
TEST    AX,4000
JZ      IS_286
```

branches on the last line, then the CPU is a 286. If not, it's a 386 or a 486.

Differentiating between a 386 and a 486 requires one more step. If you're writing 386-specific software, you won't need this, because anything that will run on a 386 will also run on a 486. But soon we'll see 486-specific software as well.

The following code sequence, which tests the CPU's ability to retain data in register CR0's cache write-through bit (bit 29), separates 386s from 486s.

```
MOV   EAX,CR0
MOV   EBX,EAX
XOR   EAX,20000000H
MOV   CR0,EAX
MOV   EAX,CR0
CMP   EAX,EBX
JE    IS_386
```

WHATCPU.SCR — **COMPLETE LISTING**

```
A 0100
JMP  0123
DB   0D,0A,"CPU is an 80$"
DB   "86$"
DB   "286$"
DB   "386$"
DB   "486$"
DB   0D,0A,"$"
MOV  AH,09                  ;Print opening message
MOV  DX,0102
INT  21
MOV  DX,0111                ;Test for 8088/8086
PUSH SP
POP  AX
CMP  SP,AX
JNZ  0166                   ;Branch if test positive
MOV  DX,0114                ;Test for 286
PUSHF
POP  AX
OR   AX,4000
PUSH AX
POPF
PUSHF
POP  AX
TEST AX,4000
JZ   0166                   ;Branch if test positive
MOV  DX,0118                ;Separate 386s from 486s
DB   0F,20,C0               ;mov eax,cr0
DB   66,8B,D8               ;mov ebx,eax
DB   66,35,00,00,00,20      ;xor eax,20000000
DB   0F,22,C0               ;mov cr0,eax
DB   0F,20,C0               ;mov eax,cr0
DB   66,3B,C3               ;cmp eax,ebx
DB   0F,84,06,00            ;je  0166
DB   BA,1C,01               ;mov dx,011C
DB   0F,22,C3               ;mov cr0,ebx
MOV  AH,09                  ;Print CPU type
INT  21
MOV  AH,09                  ;Terminate line and exit
MOV  DX,0120
INT  21
RET

N WHATCPU.COM
RCX
72
W
Q
```

Figure 1: This DEBUG script creates a small utility that identifies what type of CPU it's run on.

The cache write-through bit isn't implemented on the 386 and thus can't be written to; on the 486, where it is implemented, it can.

A branch in response to the JE (jump-if-equal) instruction on the last line means the CPU is a 386; if execution falls through, then it's a 486. If you use this code sequence with MASM, remember to include a .386P directive in your source code to enable assembly of privileged 386 instructions.

The DEBUG listing shown in Figure 1 creates a short program called WHATCPU.COM that identifies a CPU as an 8086, 286, 386, or 486. An 8088, 8086, 80188, 80186, V20, or V30 is generically identified as an 8086. Since DEBUG won't assemble the 386 instructions necessary to distinguish between the 386 and the 486, 386-specific instructions are entered manually, using DEBUG's DB command. Also, don't type in the comments on the right; doing so will cause errors on lines that begin with DB.

In a future issue, we'll extend these principles to identify math coprocessors. In the March 13, 1990, Tutor column, we looked at code for verifying the presence of a math coprocessor. Our next task will be to determine what type of math coprocessor it is.

ASK THE TUTOR

The Tutor solves practical problems, explains points of general interest about using your hardware and software more productively, and answers basic questions about DOS and systems in general. To have your questions answered here, write to Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016, or upload them to PC MagNet (see the "By Modem" sidebar in the Utilities column). We're sorry, but we cannot answer questions individually. ■

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Connectivity

- OEMs, VARs, AND INTEGRATORS: From whom should you buy your network?
- SINGLE-USER SOFTWARE: Managing software that wasn't designed for use on a network.
- PERSONALIZING YOUR NETWORK: User login scripts let you set the correct path *and* make your network friendlier.
- A SMALL PACKAGE: Here's a good 3270 terminal emulation program that doesn't use much memory.
- CHOOSING NETWORK ADAPTERS: It usually pays to stick with the standards.

OEMs, VARs, AND INTEGRATORS

We recently heard about a company called Compex, which can provide us with a Novell *NetWare* network. Compex's literature says it's a Novell OEM. What's the difference between buying from this company or buying from a local store like Businessland?

Simon Pearlstein
Daytona, Florida

The designations *original equipment manufacturer, systems integrator, and value-added reseller* are confused today. In general terms, a Novell OEM such as Compex or Gateway sells *NetWare* and manufactures products that integrate with and complement *NetWare*. They add value to the sale through features, performance, and support. Typically, they don't sell to the end user but have dealers and VARs who do. The *NetWare* they sell is usually, but not always, Novell's latest release.

The model of a systems integrator has changed significantly over the last two or three years. Early systems integrators, such as Computer Sciences Corporation, advertised that they studied your particular problems and objectively supplied the most cost-effective solution. They were thought of as pragmatically taking products from many sources and adding value through integration skills.

Recently, however, companies that make their own products, like Honeywell Bull, DEC, 3Com, and even IBM have stepped up to integrating their products into a customer's multivendor system, acting as systems integrators for larger accounts. The new breed of producers-as-integrators have great skills but perhaps somewhat less objectivity than traditional systems integrators.

A value-added reseller, like Businessland, offers its integration skills and support and perhaps a bit more objectivity than a modern systems integrator/manufacturer. Unlike systems integrators, VARs usually tend to focus more on small geographical areas, although many VARs work in vertical application markets across the country instead. The VARs believe that this focus allows them to increase their responsiveness to their customers.

Companies like Compex and Gateway have certified *NetWare* engineers and training people on their staffs. Because support is such an important part of the value they add, if you buy their products, you usually get more free, high-quality support than you'll get from Novell.

My advice is simple. The three most important considerations when deciding to buy a network are support, support, and support. Find a vendor who combines good technical support skills, responsiveness, and the likelihood of being in business next year.

SINGLE-USER SOFTWARE

I've always found Connectivity and User-to-User to be the most useful sections of *PC Magazine*. I hope other readers will find this advice helpful. We constantly get software packages from our accounting department meant only for standalone PCs, not networks, and I often encounter two problems with them. The first occurs when I call the vendors for help. They freak out when they hear the word LAN, because there's supposed to be only one user per license. The other problem I run into is with INSTALL .EXE utilities that expect to work on the C: drive.

The latter problem is easy to solve by remapping a network drive to C: during the installation. You often have to enter the program the first time using the networked C: drive to change the path the program uses to look for overlays and subdirectories. Set it up for its real networked drive and then remap everything back to normal.

In order to ensure that the software is used legally, I wrote a batch file that searches for a flag file called LOCKED. If the batch file finds the flag file—which indicates that the program is in use—it terminates. If the batch file doesn't find the flag file, it creates it and then calls the program. The batch file erases the flag file when the program terminates.

This works fine for most single-user programs, but when you have two or three copies of the software, it doesn't work so well. Do you know of a way to do this without spending money for a software package that would just take more memory?

Robert Coventry
Peoria, Illinois

Because the programmers who write code that isn't designed for network use can handle open files any way they want, it isn't wise to allow multiple simultaneous use of these programs—even if you do have several legal copies sitting on the shelf. One copy of the program can change data files, overlays, and configuration files, without regard for

the other active copies. This is begging for trouble.

Instead, put full copies of the program into multiple subdirectories on the server. Use your flag-setting batch file in each subdirectory. Don't let the programs trample each other.

By the way, writing software that is "network aware" is so trivial that you have to question the age of and planning that went into products without this capability. The network file options first provided in DOS 3.1 are easy for programmers to use, and they've been around a long time.

PERSONALIZING YOUR NETWORK

I've been an avid reader of *PC Magazine*, particularly the Productivity section, since 1984. I've saved every issue and this practice paid off recently when I became a LAN administrator on a Novell *NetWare* ELS II system.

One area where I need some guidance is in mapping each workstation or user to the proper directories on the server while keeping the local path drives and directories intact. It seems that when a user logs into the network, the path set up by the AUTOEXEC.BAT is erased.

Michael LeBlanc
Stamford, Connecticut

Mr. LeBlanc provided a sample of his clever System Login Script. He uses simple checks of the date and time to personalize the network. For example, you can put this in any System Login Script:

```
IF "%HOUR24" < "08" THEN BEGIN
     WRITE
     WRITE "Commendable! You are
      logging in early today!"
     WRITE
END
IF "%DAY_OF_WEEK" = "SATURDAY"
 THEN BEGIN
     WRITE
     WRITE "Awfully tough to have
      work on a weekend!"
     WRITE
END
```

You can string together several such checks and comments to make the network a friendlier place.

But Mr. LeBlanc is correct that the *NetWare* shell provides a simplified path statement to DOS. The only solution is to use the Novell menu system to create individual user login scripts with the proper mapping for each person. This is redundant work and a pain to keep updated, but it's the only way. On the bright side, personalized user scripts allow you to check the login date for birthdays and other important dates—like full vesting in the profit sharing plan—and add appropriate comments.

A SMALL PACKAGE

We use our networked PCs primarily to access an IBM mainframe through an SNA gateway as DFT terminals. Memory management in the PCs is a problem because people want to bounce between the mainframe session and, for instance, a spreadsheet. Who has the smallest 3270 terminal emulation program we can use?

Carsten Lynn
Newport Beach, California

Good things do come in small packages. At 60K, the smallest memory-eating 3270 DFT-mode emulator we can find is *3270/Elite*, from Network Software Associates. It runs with practically any coaxial adapters, network, or Token-Ring attachment. The package is packed with features like full SAA/CUA screens. A single copy runs $245, but the company discounts multiple copy buys. For more information, contact NSA at (714) 768-4013.

CHOOSING NETWORK ADAPTERS

We just started planning for the purchase of a network. I understand that we can run different operating systems over various types of adapters, so we have a lot of choices. What are the differences among such adapters as ARCnet and Ethernet and the less-expensive adapters that come in a kit from, say, Artisoft?

William Mudd
Pittsburgh, Pennsylvania

The adapters you choose determine the wiring, signaling, and media access systems for your network. The systems that meet IEEE or industry standards are Ethernet, Token-Ring, and ARCnet.

The tidy picture gets a little complex because each of these systems can use at least three different wiring options. Ethernet, ARCnet, and Token-Ring adapters can, with the right selection of products and add-on parts, operate over shielded metallic cable, unshielded twisted-pair (telephone) wire, or fiber-optic cable. You can pick and choose and even mix and match wiring.

I've found two catalogs that will give you an excellent picture of available wiring products and options. South Hills Electronics produces a Local Area Network Products Catalog that includes descriptions of many wiring alternatives. People who use thin Ethernet should particularly see the AMP Communications Outlet System. The components of this AMP system cost as if they're made of gold, but they make a beautiful single-wire thin Ethernet installation. Contact South Hills Electronics at (800) 245-6215 and ask for the LAN Products catalog.

Another excellent LAN products catalog is available from Black Box Corp. I don't see how you can have anything to do with LANs and not have this catalog on the shelf. The prices aren't always the lowest, but it will have what you want. Phone Black Box Corp. at (412) 746-5530 and ask for the LAN catalog.

A word of caution about the less-expensive nonstandard adapters available from several companies: If you use a network cabling, signaling, and media-access scheme that doesn't meet the ARCnet, Ethernet, or Token-Ring standard, you've bet your future on the success of the company providing that proprietary adapter. If you want to upgrade to *LAN Manager* or *NetWare*, it's very likely that you'll have to throw everything out and start all over. And if you want to expand your network, you might find surprising limitations—or even the dreaded " . . . the number you have called is no longer in service . . . " recording. Stick with ARCnet, Ethernet, or Token-Ring. You have plenty of options and good economy with those alternatives.

NETWORK YOUR QUESTIONS

Connectivity gives you practical solutions to networking problems of all types. We'll pay $50 for any tips we print. Please submit your letter on a disk along with a printout. Then mail your contributions to Connectivity, *PC Magazine*, One Park Avenue, New York, NY 10016, or you may contact Frank J. Derfler, Jr., via MCI Mail (be sure to use Derfler's box named PC MAGAZINE LAN LABS). We're sorry, but we're unable to answer letters individually. ■

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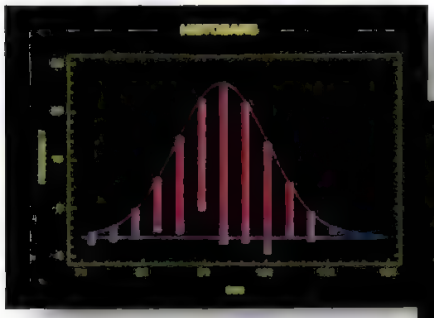

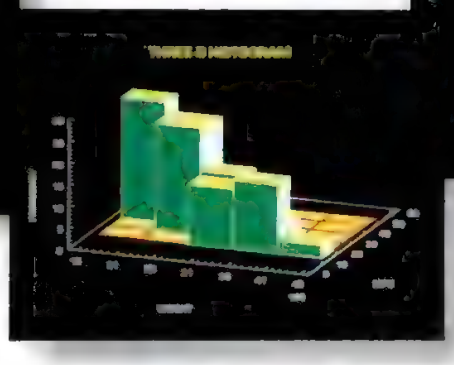

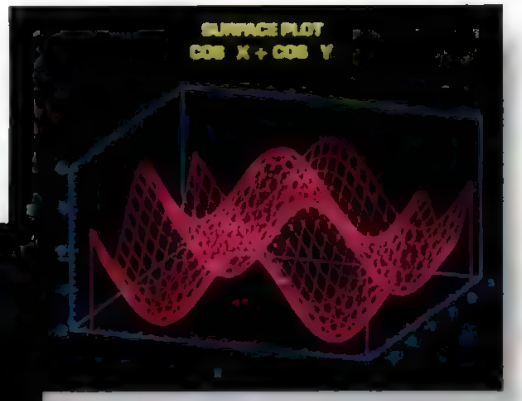

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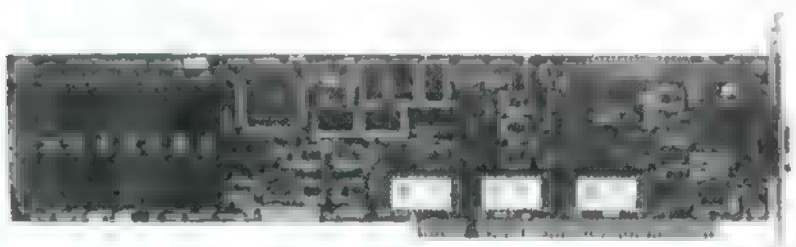

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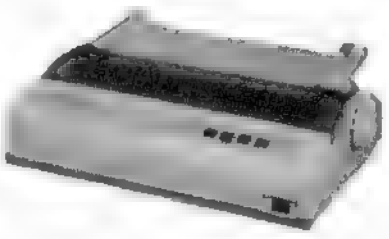

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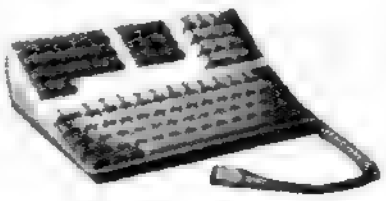

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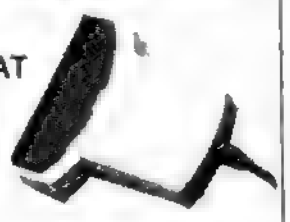

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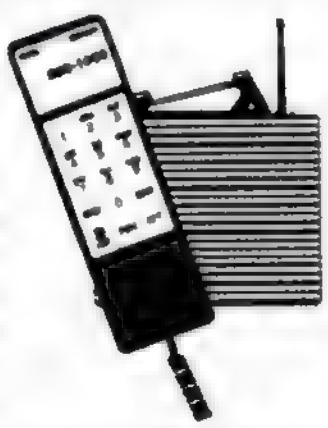

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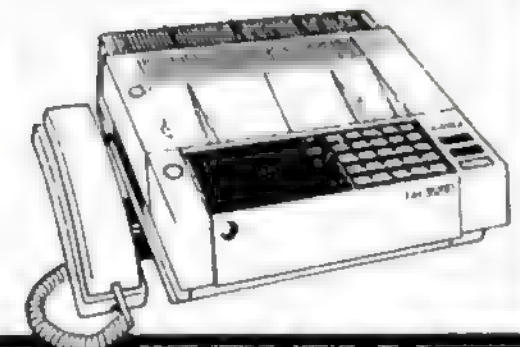

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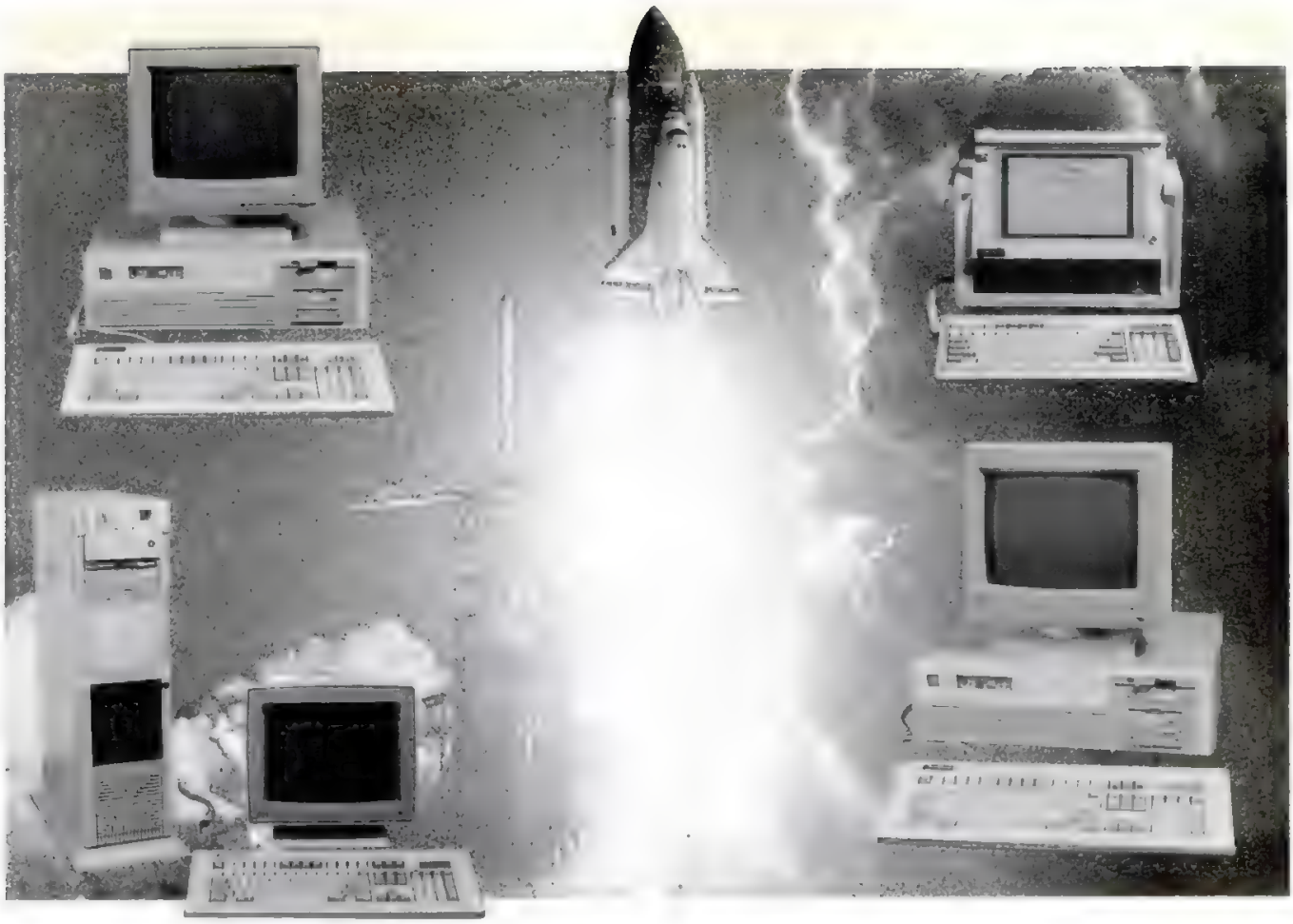

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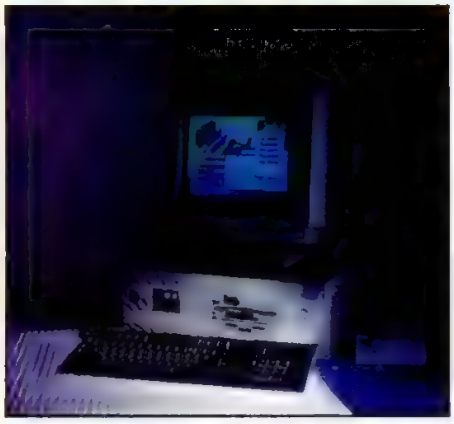

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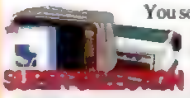

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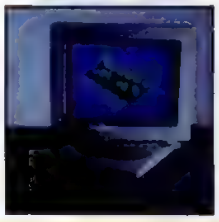

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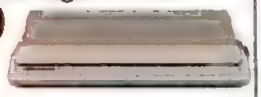

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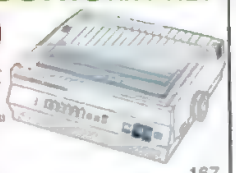

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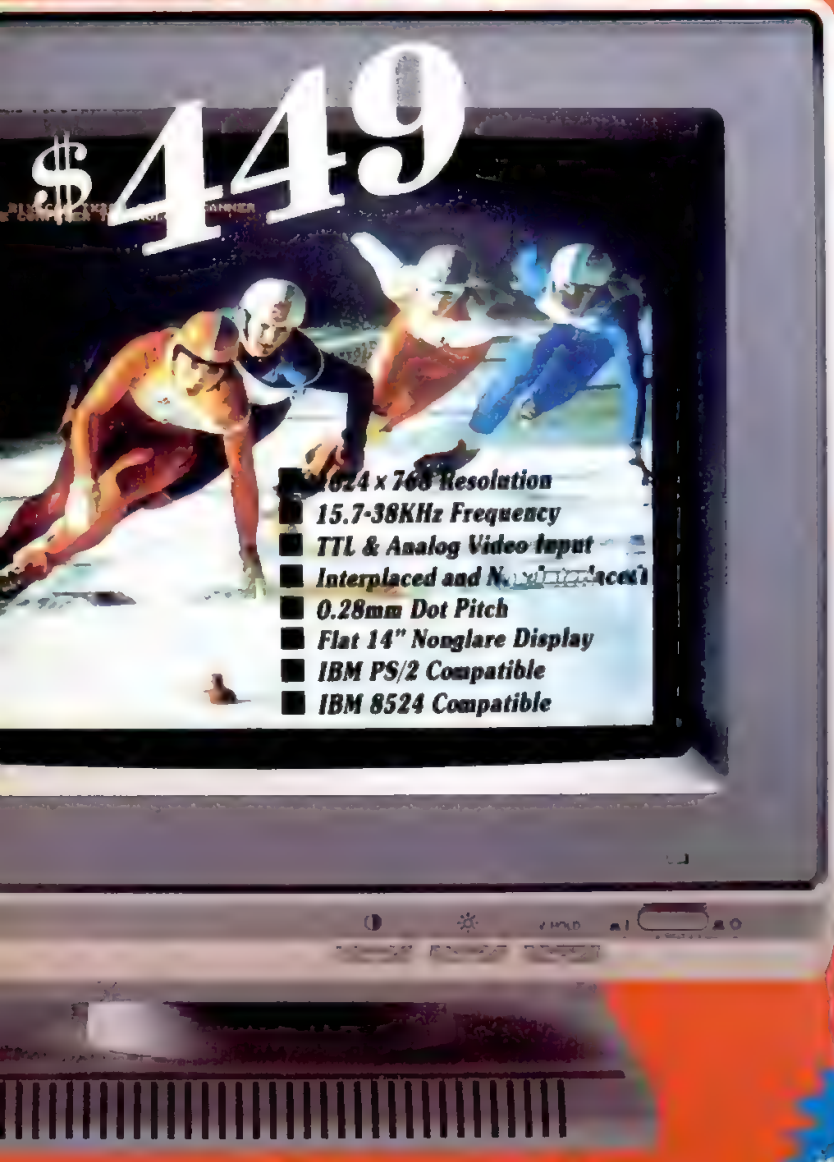
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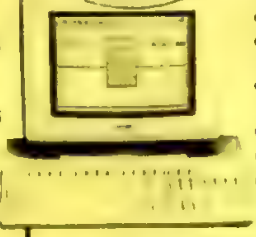

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7. Do you plan to buy any PC product?
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u. ☐ In 4 to 6 months
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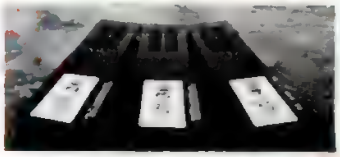

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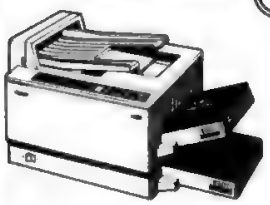

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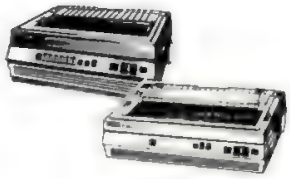

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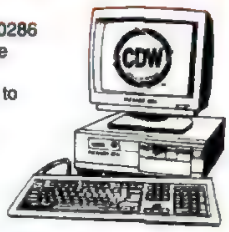

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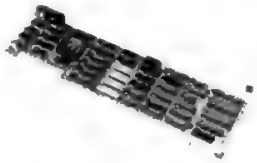

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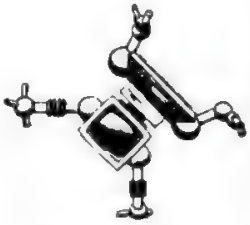

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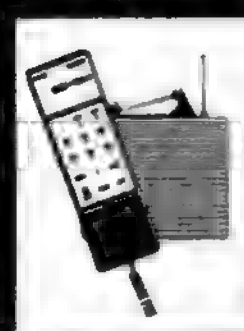

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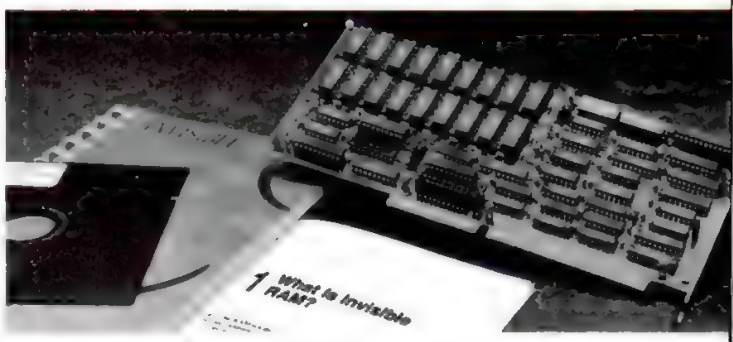

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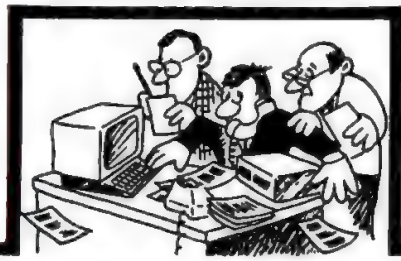

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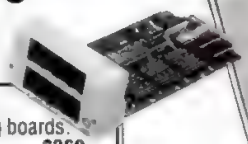

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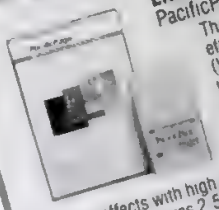

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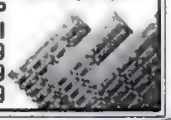

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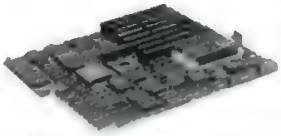

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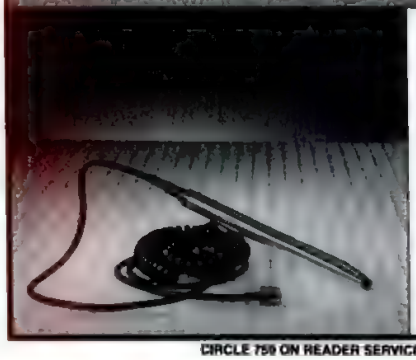

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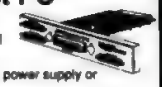

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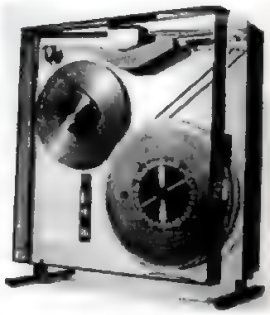

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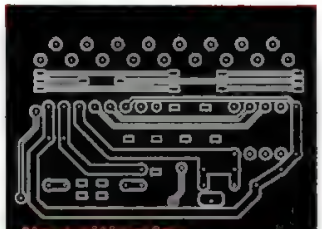

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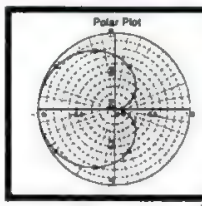

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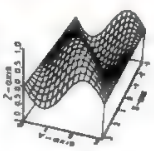

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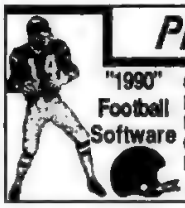

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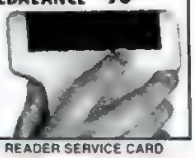

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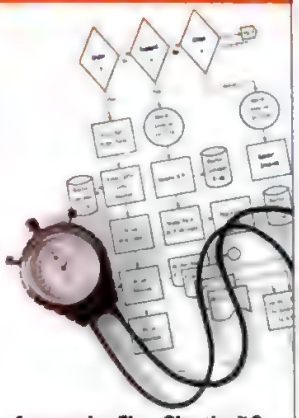

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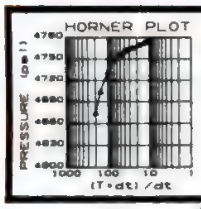

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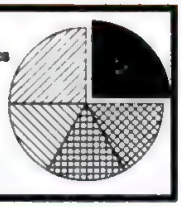

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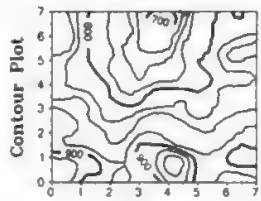

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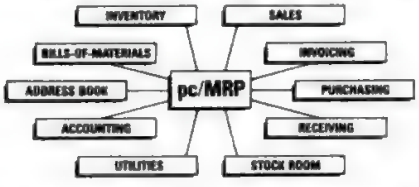

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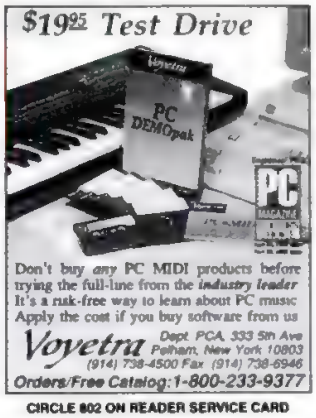

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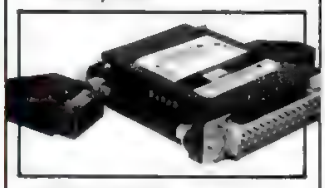

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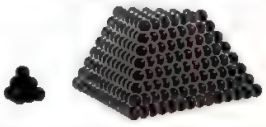

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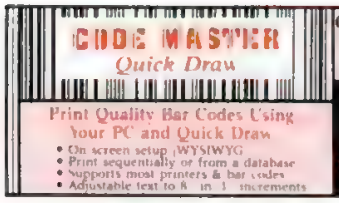

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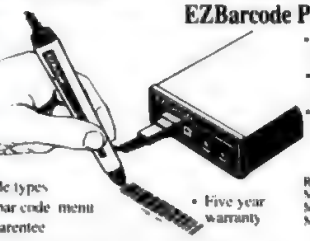

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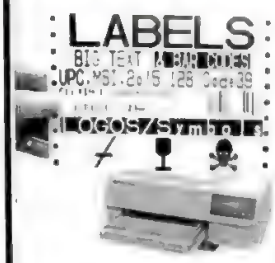

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COMING UP

■ 16-MHz 386SX PCs

With 16-MHz 386SX machines selling strongly, the SX has become the business desktop PC of choice. PC Labs tests 20 fully-equipped SXs for less than $1,850 each, and takes a peek at the developing 20-MHz SX market. Will it kill the 20-MHz 386?

■ GRAPHICS FILE CONVERSION UTILITIES

Today's desktop publishing packages can import graphics, but if you get art from a variety of sources, you'll need something stronger. We test four graphics file-conversion programs that handle numerous bitmapped file formats—.PCX, .TIF, .EPS, .GIF, .IMG, Macintosh .PNT and others.

■ ALTERNATE INPUT DEVICES

With the rising popularity of the graphical user interface, users are realizing the need for an input device that can perform duties beyond those of the keyboard. Enter the mouse and the trackball; two alternate input devices that are better suited for the GUI environment than the keyboard. We'll show you how products from 35 vendors compare.

■ FAX BOARDS

PC Magazine's last roundup of internal fax boards found a maturing market, but one with more room for improvement. Intel, The Complete PC, Quadram, and others came out strong, but the software remained clunky. Workgroup systems editor Frank Derfler leads the charge into the latest advances in fax transmission.

■ TERMINALS GROW UP

Terminals running applications under multiuser operating systems like VM/386 and Unix never got much attention when it came to graphics. But with the growing usage of CAD and other graphics-hungry applications, the first models supporting color graphics are ready for prime time. PC LAN Labs evaluates three affordable terminals. ■

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After Hours

Products for the Leisure Side of Personal Computing

Poetry Composition Software Brings Out The Bard in Poets and Laymen Alike

WRITING AIDS
by Rink Murray

The great poet Samuel Coleridge once said that science is the opposite of poetry. Science, he argued, is an unemotional pursuit of truth, while poetry—the communication of immediate pleasure—is emotional by definition. Modern-day poet Michael Newman has successfully combined these two opposites. With his array of poetry composition software, Newman uses science, in the form of computer technology, to make writing easier for both laymen and accomplished poets—to make poetry a more immediate pleasure.

His *Poetry Processor* is a word processor specifically adapted to help writers create competent, rhymed verse. It has most of the basic capabilities you would expect of a standard word processor. You can cut and paste, output to a printer, or even save your work as an ASCII file for export to your favorite word processor. The readily available, context-sensitive help virtually eliminates the need for the sparse documentation.

By default, the program is configured to help generate free verse. If this setup doesn't suit you, merely press the Alt key to get to the Forms Editor. From there you can choose any style of verse you desire—anything from a Shakespearian sonnet to a limerick. If the program doesn't have the style you want, you can create and save one in a matter of seconds.

Once you've made your selection, an electronic template pops up and displays the required rhythm and rhyme schemes. If you prefer, you can opt for a split screen and call up a model poem, such as Keats' "Ode On A Grecian Urn," to serve either as an example or a target for parody.

As you write, a window in the top left-hand corner of the screen indicates the meter for the line you are writing, and a color-coded bar to the right shows which lines must have identical rhymes. When you've finished you can ask the *Poetry Processor* to check your work for you.

With a high degree of accuracy, the program politely informs you if your lines differ from the specified syllable count. You can even ask the program to "play" the poem like a song, and it responds by be-bopping (through the PC's speaker) to the correct rhythm.

If you're stuck and need a rhyme, just press F10, and bingo, you've accessed the built-in rhyming dictionary. As any working poet knows, rhyming dictionaries do much more than aid in the construction of rhymes; the words they offer can suggest possible directions for the poem to take.

Unfortunately, the built-in dictionary is limited to 17,000 entries, and doesn't recognize some words. You can add words to the dictionary, but that isn't easy, since the documentation doesn't give you any help. When I tried to add the word *kind*, the program insisted on placing it with wind—the kind of wind that blows.

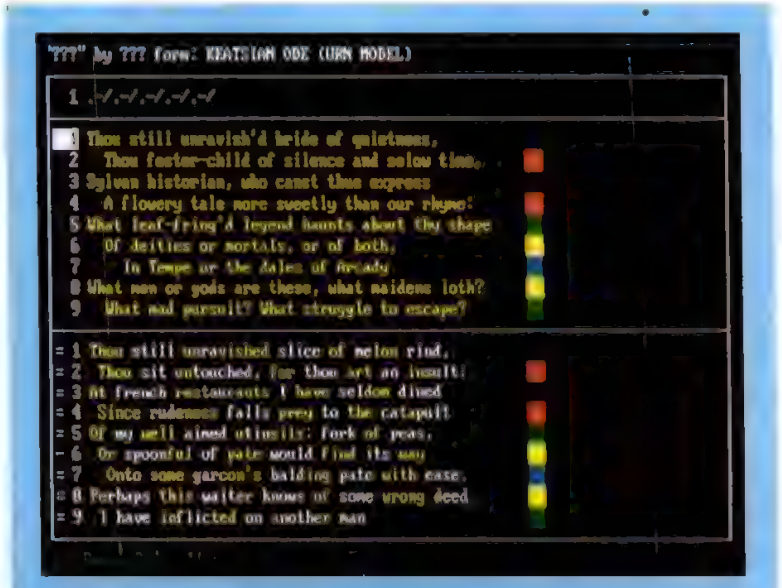
To help with this problem you might consider *N.E.R.D.*, (Newman's Electronic Rhyming Dictionary). *N.E.R.D.* is a slick TSR (terminate and stay resident) program compatible with any word processor. To access *N.E.R.D.*'s stout warehouse of 25,000 well-chosen words, you simply press both Shift keys at once, and let the screen guide you through the expansive worlds of rhyme, consonance, and assonance.

Just type in the word you want to rhyme, and in a flash a list of potential jingles appears before you. And it doesn't stop there; every word is cross-referenced to words that sound similar, but don't quite rhyme. You can expand the library with your own entries if you desire.

A similar program, called *The Poet's Companion*, is available from Writer's Software for $29.95. This self-installing TSR application lacks *N.E.R.D.*'s consonance and assonance facilities; however, it houses a more complete library of 60,000 words.

If you're not a great poet, the *Poetry Processor* probably won't

CONTINUES



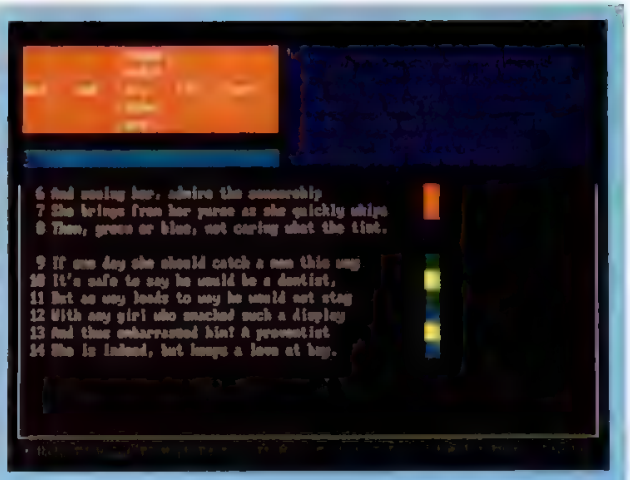
The *Poetry Processor* has a split-screen view that allows you to use a famous poem as a model for imitation or parody.

Poetry

CONTINUED

turn you into one. But aspiring and established poets alike will find the *Poetry Processor* and *N.E.R.D.* to be valuable tools. Just as word processors eliminated tedious and repetitive typing tasks, the *Poetry Processor* frees the poet from wearily counting every syllable and searching for rhymes in large, book-bound rhyming dictionaries. Because the software kept me focused on meter and told me when and where I went awry, I found myself writing better sonnets in about one-third of the time it usually takes me to produce them.

In the past, programs like the *Poetry Processor* have met with criticism from people who think that poetry software will replace creativity. They fear a tidal wave of verse from ordinary people.



A helpful rhyming dictionary is available from within the *Poetry Processor* at the tap of a key.

Perhaps these critics are afraid they won't be able to distinguish the common writer (working with the right tools) from the great poets. That would be roughly the equivalent of mistaking a four-year-old boy for Superman.

As for the pricing of NewManWare, Newman offers several schemes. For $89.95 you can purchase the *Poetry Processor, N.E.R.D.* Version 1.0 (the scaled-down, non-TSR version), and *Orpheus ABC*—a tutorial that guides you through the various forms and meters. The TSR version of *N.E.R.D.*, Version 1.1, sells separately for $49.95. But I would recommend buying the complete package, which sells for $129.95.

If you're an aspiring poet, or a songwriter, or if you simply want to learn something about poetry, consider trying Michael Newman's software. It might just give you some faith in your abilities.

List Price: *Poetry Processor, Orpheus ABC, N.E.R.D.*, Version 1.0, $89.95; *N.E.R.D.*, Version 1.1, $49.95; all programs together, $129.95. **Requires:** 256K RAM, DOS 2.1 or later. NewManWare, 84 Front St., New Haven, CT 06513; (203) 498-9346.

CIRCLE 407 ON READER SERVICE CARD

List Price: *The Poet's Companion*, $29.95 plus $3 for shipping. **Requires:** 12K RAM, DOS 3.0 or later. Writer's Software Inc., 1005 AGC Dr. NE, Cleveland, TN 37312.

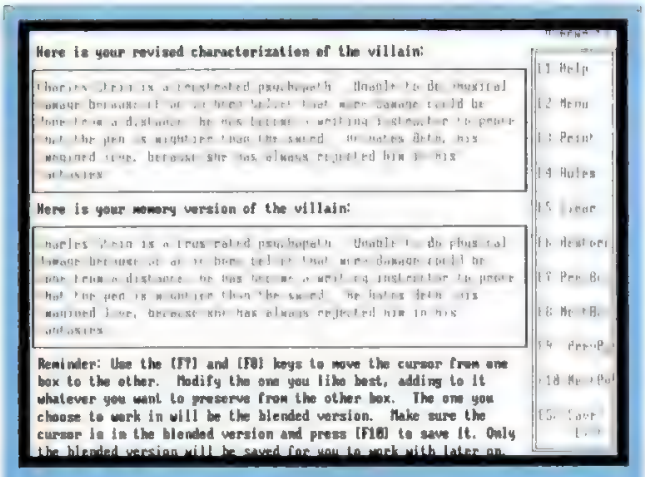
CIRCLE 408 ON READER SERVICE CARD

WritePro Offers Budding Fiction Writers a Structured Approach to Enhanced Creativity

WRITING AIDS
by Nathaniel Zelnick

"Where do you get your ideas?" is the question asked most frequently of creative writers. It's an almost impossible question to answer, since ideas often pop up at odd times and from unlikely places. Sol Stein's *WritePro* software won't put an elusive muse at your beck and call, but it will teach you some rules and techniques for stimulating your creativity when you sit down to write.

WritePro intertwines a simple word processor with a primer on the fundamentals of character and plot development; a series of lessons presents the basic rules of the Stein writing method. You follow the lessons from the first rule of character motivation (an interesting character must have a problem that needs a solution) to more-complex concepts like the development of a narrative perspective and the creation of seamless, flowing plots. Tips on using dialogue and setting a scene are particularly helpful.



WritePro's lesson structure encourages reexamination of your work to stimulate your creative processes.

WritePro's real strengths stem from its emphasis on the mechanical process of creating fiction. The most helpful point of each lesson is repeated until you are forced to examine your plots and characters from many different angles. This resembles the "cube" brainstorming method, in which you examine at least six aspects of an idea as if they are faces of a cube.

When helping you create a character, for instance, the program starts with the prompt "Beth Riley wants . . . " and asks you to fill in a basic need. *WritePro* then repeats your brainstormed response, with software-generated questions or comments. You are compelled to reexamine and rework your material until you have a satisfactory character description. The emphasis is on critically looking at and thinking about the creative process in order to unlock your imagination.

DISCIPLINE STILL REQUIRED

This is a conducive environment for brainstorming, and helps to get your creative juices flowing, but you'll still have to discipline yourself in order to benefit from the rules and suggestions. The hardest part of self-editing is learning to look at your work objectively; distance is nine-tenths of Stein's law.

While the documentation claims that the program eliminates trial and error, it also admits that trial and error is the very heart of creative writing. The Stein method boils down to a simple maxim: writing is rewriting. The software can prompt and suggest solutions, but the grunt work is still yours to do.

Though real persistence is

CONTINUES

WritePro

CONTINUED

necessary to get the most out of *WritePro*, the program is nevertheless designed with backsliders in mind. While it automatically keeps track of your progress, saving your scattered thoughts and marking your place in the program, it is designed for easy repetition of each lesson. If you have a particular problem in your writing, or find yourself blocked, you can focus on the lesson that deals with your specific difficulty.

Paper is patient, as Anne Frank pointed out, and software is even more so. *WritePro* can't become impatient with you, as a human tutor might.

WritePro is no cheap solution. At $79.95 for the first four lessons ($39.95 for each subsequent two-lesson package) it is an expensive writing guide. But if you think you have the will, then this program will help you find the way out of some common creative writing traps. Like any formula for writing, it is far from perfect. But *WritePro* does offer some suggestions that can aid you in becoming your own toughest critic.

List Price: *WritePro*, $79.95 for initial four lessons, $39.95 for each additional two-lesson package. **Requires:** 256K RAM; DOS 2.0 or later. The WritePro Corp., 43 Linden Circle, Scarborough, NY 10510; (914) 762-1255.

CIRCLE 409 ON READER SERVICE CARD

You Must Find the Killer in Sierra's New Mystery Game

GAMES
by Don Trivette

A young woman drops a towel and steps into a running shower. Suddenly there's a violent disturbance as a knife hacks through the wet shower curtain. Blood mixes with water and runs down the drain. Where have you seen that scenario? It could have been in *Colonel's Bequest*, the latest adventure game from the pen of Roberta Williams.

The hero of *Colonel's Bequest* is Laura Bow, a young college student visiting a friend's family at their Louisiana plantation. It soon becomes clear that members of the Dijon family are being systematically murdered, and it is up to Laura to stay alive long enough to discover the identity of the killer.

The cast of characters is typical of those found on any fictional Louisiana plantation in 1925. Lillian Prune, Laura's classmate, drinks, smokes, and does the Charleston. Gloria Swansong, a beautiful blonde, loves money and rich boyfriends.

Laura Bow, a vacationing college student, must figure out who is bumping off her hosts in the *Colonel's Bequest*.

Rudy Dijon is a gambler, a womanizer, and a drunk. Clarence Sparrow, the Colonel's attorney, lusts after the Dijon fortune. Fifi, Jeeves, and Celie are the Colonel's faithful (or are they?) servants.

Bequest is more like a play than other Sierra games, and, as such, it is organized into eight acts. Transitions from one act to the next are triggered by your own exploration and investigation. For example, the first act doesn't end until you've observed four specific events. You watch Lillian in the guest room, Fifi and the Colonel in the bedroom, Rudy and Gloria in the billiard room, and Clarence and Gertie in the parlor. You know you've hit one of the key events when a clock face appears on the screen and the hands advance by 15 minutes. *Bequest* has no scoring, but that's not a handicap because you get a sense of progress from the trigger events and the passing of the acts.

This adventure gives back what you put in to it. You can solve the *Colonel's Bequest* with a minimal amount of sleuthing, but if you take that approach you'll miss rich details like the shower scene and the subplot involving the Crouton family. Indeed, if you play for speed you'll miss all the fun, but at the end of the game, after you've solved the mystery, you can request hints about parts of the plot you didn't see. Then you can go back and watch Fifi and Jeeves, for example, carrying on like a couple of rabbits.

Colonel's Bequest concentrates more on information gathering and less on action than other adventure games. Instead of scaling cliffs, shooting criminals, and slaying dragons, you wander from room to room questioning people and observing their actions. I prefer Indiana Jones to Jane Marple, but the *Colonel's Bequest* is sure to have a big following with murder-mystery fans.

List Price: *Colonel's Bequest*, $59.95. **Requires:** 512K, DOS 2.0 or later, graphics adapter. Hard disk drive and 8 MHz or faster processor highly recommended. Supports optional sound cards. Sierra On-line, P.O. Box 485, Coarsegold, CA 93614; (800) 326-6654.

CIRCLE 410 ON READER SERVICE CARD

ABOUT THE AUTHOR . . .

by Don Trivette

Once upon a time in Los Angeles there lived a bored housewife named Roberta Williams. Instead of watching soap operas while her husband was away at work writing accounting programs, she played computer adventure games. Adventure games in those days lacked both graphics and animation; they were in fact exercises in reading. Then one day Williams suggested to her husband that instead of a more conventional diversion like planting a vegetable garden or painting the living room, they write their own game.

The young couple set to work and eventually turned out *Mystery House*, described by the author as a combination of an Agatha Christie novel and the parlor game *Clue*. It was the first graphic adventure game (though the graphics were in black and white) and it was a phenomenal success. The couple expanded their operation, and it grew into the very successful Sierra On-line.

Roberta went on to write the four best-selling *King's Quest* adventures. Now she has come full circle with the *Colonel's Bequest*, a game with a story line reminiscent of the original *Mystery House* but with graphics, animation, and sound like a motion picture. She's come a long way in just ten years, and so has the genre she invented. ■

The Learning Co. Hides Math in a Fast-Paced Game

EDUCATION
by Robin Raskin

The kids swore that if I brought home another educational computer game they'd revolt, but I sure tricked them. *Outnumbered*, the second in The Learning Co.'s *Super Solvers* series, offers such compelling play that they barely noticed they were mastering one of the toughest educational hurdles of them all . . . the math word problem.

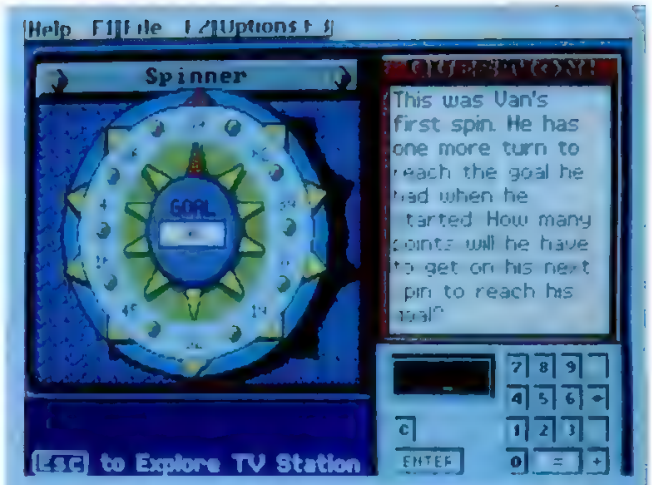
Outnumbered takes the best of each of the various computer game genres and combines it all in one enjoyable learning experience. It's got the plot, music, and graphics of a top-notch adventure game, the shoot 'em up action of an arcade game, the decoding skills of a strategy game, and the educational value of a drill, all rolled into one. And it pushes the computer drill to new levels of sophistication. Where most drill games drop off after they ask what 5 multiplied by 4 equals, *Outnumbered* poses some thought-provoking yet playful questions involving map and chart reading, graphs and tables, and paragraph style word problems.

The plot that binds the elements together asks us to suspend reality a bit, but with action so alluring, who cares? Morty Mischief, a dastardly villain who looks like Albert Einstein on LSD, is out to take over the Shady Glen TV station. Your child plays the part of a cool looking, androgynous sleuth with a pulled-down hat, a turned-up collar and a mean shuffle. Armed only with a "zapper," he (or she) combs the various rooms of the Shady Glen TV station in search of clues. The music-to-travel-by is wonderful.

Each room at the station (News, Game, Sound Studio, etc.) has a math challenge hidden behind some piece of equipment. The challenges are loosely related to the nature of the room.

Heightening the excitement is the fact that your child works with limited time and limited energy. Of course, there's an energy machine in one of the halls, but it only dispenses juice if the player has risen to the math challenge.

Then there are those mischievous henchman—a robot named Telly and a slithering electrical cord named LiveWire. When your child spots them he's got to either zap them with the zapper or do some wild flips and jumps to avoid their weaponry. This requires some pretty fast reflex action on the keyboard (there's no mouse support), and, as your child gains in rank, the action becomes more frenetic.



Outnumbered presents math word problems as a well-integrated part of a fun and challenging game scenario.

Zapping Telly's belly brings the player face to belly with a screenful of quick math drills. Here, *Outnumbered* builds rote skills in multiplication, division, addition, and subtraction. Surviving the drill forces Telly to divulge a piece of the code that reveals Morty's whereabouts. Parents will be happy to know that they can customize the drills, so if a child is learning the 11's multiplication table, for example, the game can reinforce that set of concepts.

After getting a few clues under his belt, the player heads to the decoding room to confront a pattern-matching puzzle to determine which room Morty is hiding in. Taking a guess sets off a marvelous animation sequence that reveals if the answer is correct or not.

A player signs onto an *Outnumbered* case as a trainee, and progresses up the ranks to champion. The going gets tough as the math gets harder and more plentiful. The action also gets speedier and the pattern-matching becomes more cerebral.

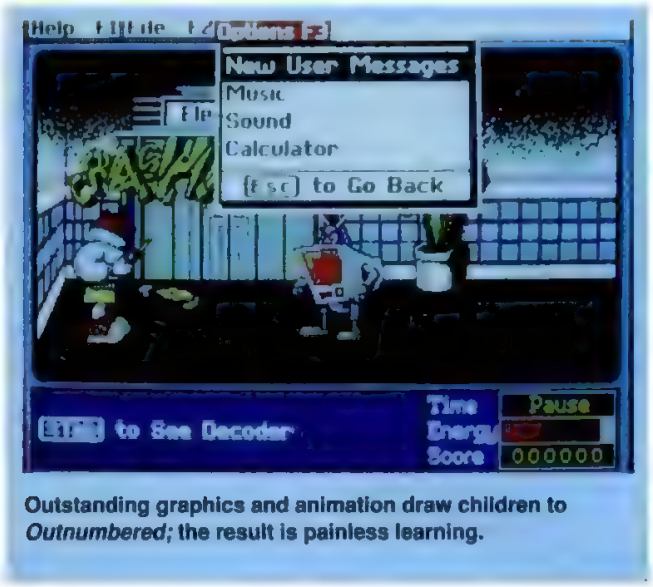
Nice touches abound. The math word problems incorporate lovely color graphics and real-world concerns. The math-problem screens have a built-in calculator that parents can enable or disable. Since the problems require serious thought, the clock that adds so much excitement to the game mercifully stops as the kids work on math. Kids even get reasonable tutorial advice on how to tackle a problem once they've given two wrong answers.

An earlier installment in the Learning Co.'s *Super Solvers* series, *Midnight Rescue*, introduced us to Morty Mischief. In that previous game, he was a frustrated ex-student with a grudge against his alma mater, the Shady Glen School. So he returned to cover the joint with disappearing paint. The sleuth roamed the hallowed halls of education trying to figure out which of five robots was really Morty in disguise. Instead of math problems, the sleuth faced some tricky reading-comprehension passages that unlocked the coveted clues.

The *Super Solvers* games are incredibly attractive. They have surprisingly good EGA color graphics screens, catchy audio sequences, and captivating animation. With any luck, Morty Mischief will become a Learning Co. regular for all sorts of skill-building titles—I know I could use some help with advanced calculus. ■

List Price: *Super Solvers Outnumbered*, $49.95.
Requires: 512K RAM (Tandy 1000 requires 640K), DOS 2.0 or later, graphics adapter. The Learning Co., 6493 Kaiser Dr., Fremont, CA 94555; (415) 792-2101.

CIRCLE 411 ON READER SERVICE CARD



Outstanding graphics and animation draw children to *Outnumbered;* the result is painless learning.

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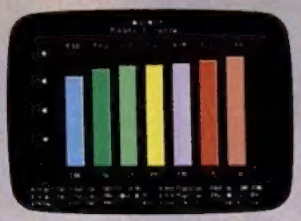

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CIRCLE 188 ON READER SERVICE CARD

by Bill Howard

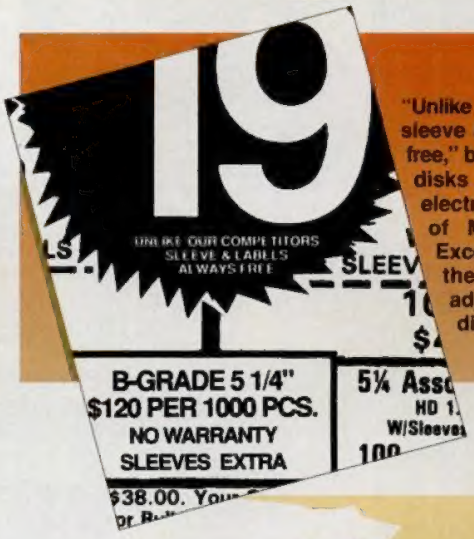
Abort, Retry, Fail?

The Lighter Side of Personal Computing

Computer Dictionary: Supertwisted LCD

"[The Bondwell Turbo 8's] supertwisted LCD with backlight makes screen easier to read. Supertwisted display means that dots are bunched closer together for sharper images."
—Sears catalog, Spring 1990

CARTOON: RICHARD TENNANT



"Unlike our competitors, sleeve & labels always free," boasts this floppy disks ad by ERM Inc. electronic liquidators of Melrose, Mass. Except, of course, in the case of the adjacent ad immediately below.

Classified Intelligence

''AT&T 6300 porcelain computer syst $750, xxx-xxx-xxxx''
—*Recycler Classifieds* (Los Angeles, Calif.), February 22-28, 1990

''386-20, $1795, 1 mg ram, 85 mg hard drive, VGA color, 1.2 floppy, tower case, 2 serial, 1 payroll, 1 game, 1 yr wrnty, software. xxx-xxxx''
—*The Dallas Morning News*, February 26, 1990

''Large new computer disk, $75. xxx-xxxx''
—*Houston Chronicle*, February 25, 1990

Now that's a sale: Liquidator Damark International has discounted this "handsome printer stand" from $8,499 to $19.
—Damark International advertisement, *PC Resource*, February 1990

News Item: Lotus, WordPerfect Now TSRs

"Headroom is a TSR (Terminate and Stay Resident). It acts like a 'Master Manager' which controls all other TSR programs (such as Lotus 123, Ventura Publisher, MS Word, WordPerfect, etc.)."
—*What's New In Computing*, January 1990

Yes, It Works, But You're Not Gonna Believe the Connector It Requires

"Connection [of the Dell 316LT portable] to a full-size VGA color or monochrome monitor is also possible with an enhanced 101-key keyboard."
—*Computer Dealer News*, January 25, 1990

If your entry is used in Abort, Retry, Fail? we'll send you $50 and a *PC Magazine* T-shirt. Caution: In case of multiple entries, the postmark date, neatness, and completeness of entry are considered. Winners this issue: Jeff Thomas (dots bunched closer), Steve Fletcher (sleeves extra), Robert Yeo (*Lotus* a TSR?), Barry Chaffe (monitor/keyboard connection), Jim Bykowski ($19 printer stand), Joel Duquette (large disk), V. Rodriguez (payroll port), Alan Bell (porcelain computer).

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